Serving the CoCo Community for

The RAINBOW

10 YEARS

THE COLOR COMPUTER MONTHLY MAGAZINE

August 1990, Vol. X No. 1

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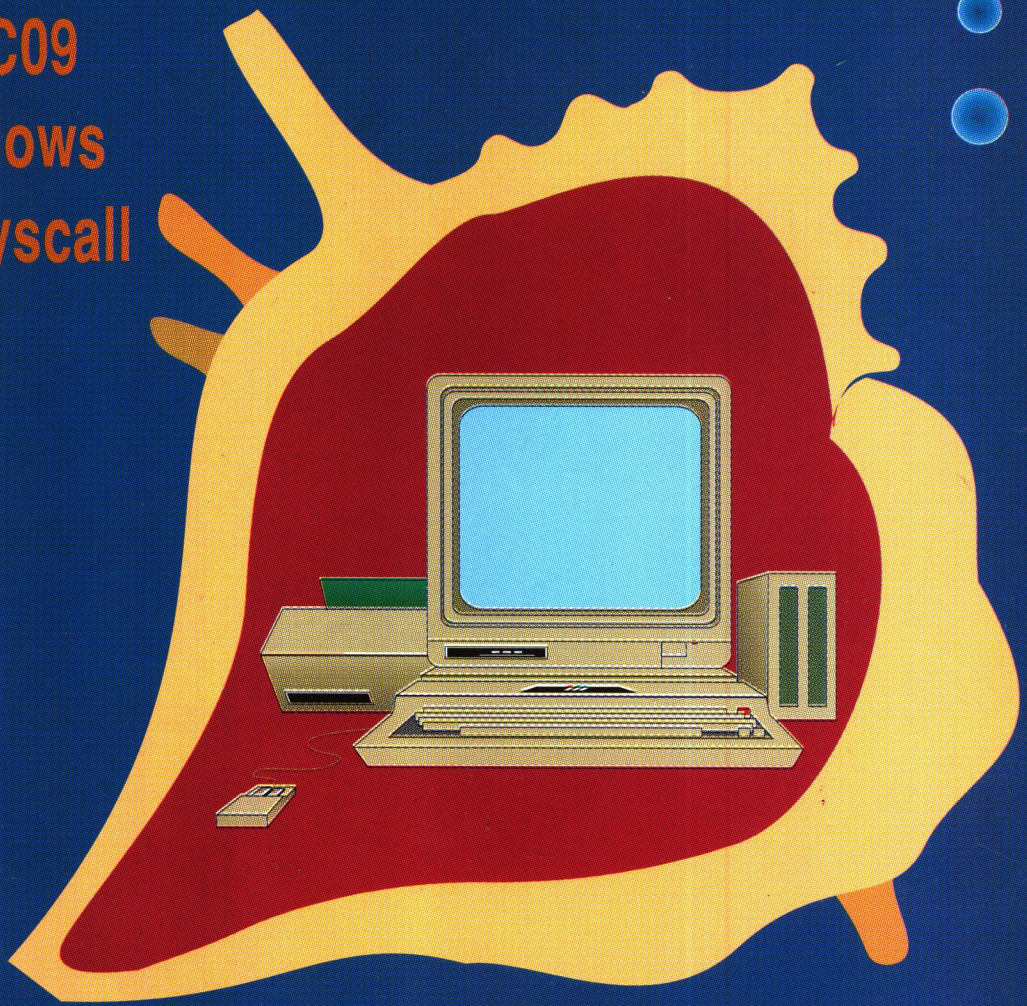

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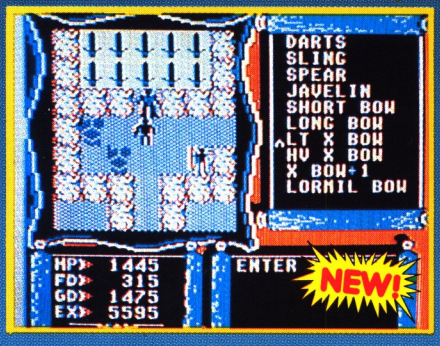

Years after the mysterious hero called the Paladin disappeared, loathsome creatures, spawned from the bowels of the planet, have overrun the land of Tarinth and captured the king. The situation is grave, for without the king's influence, the three nations will not unite against the growing evil. Only one pure of heart can master the five magics and thereby fulfill the Paladin's legacy and save the realm. Adventure into this vast land of fantasy, interract with its inhabitants, explore the ruinous mines, and do battle with supernatural forces. Experience the magic of the quest in this fast-paced role-playing adventure, all in the familiar quick scrolling, bird's eye play format. You will love the feeling of playing an action game with great graphics, animation, and sound effects, but all the while solving one of the most involved adventures yet. Tarinth awaits its savior! Available for all CoCo models! Req. 64K CoCo and disk drive.

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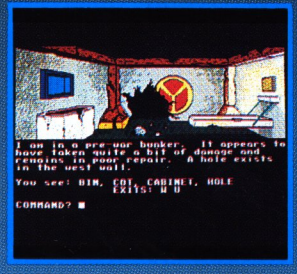

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RAINBOW 10 YEARS

Table of Contents

August 1990
Vol. X No. 1

Features

10
Cracking the Nautical Code
Jay Smith
A BASIC program that teaches you international code flags

20
CoCo 3 GIME CART* IRQs Explained
Bruce Isted
A software technique that eliminates the cartridge interrupt problem

10

36
Frustration Extinguisher
James Barnes
Now you, too, can have uncomplicated, readable listings

44
DoubleWide Dumps
John Ludwig
A program that prints double graphics screens side-by-side

52
The Assembly Line, Part III
William P. Nee
CoCo churning, wheels spinning, ideas turning

64
Living Without Line Numbers
Dean Bergmann
Will the virtues of BASIC09 never cease?

67
Who Dunnit?
Rob Becker
Elementary, my dear Watson

92
Computer Widow's Tale: STUFF
Nancy Myers
Poetry in commotion

Novices Niche

42
Spiral
John Mosley

59
CoCo 3 Joystick
Keiran Kenny

70
Line Copy
Geoff Friesen

Product Reviews

In the Limelight:
1-Meg Upgrade/*CRC Disto* ____ **83**

Arkanoid/*Data East* ____ **76**
Inside OS-9, Level II/*Frank Hogg Laboratories* ____ **80**
Notes II/*Robert Pori* ____ **81**
Overlord/*Oblique Triad* ____ **78**
Power Stones of Ard II/*Three C's Projects* ____ **78**
SuperFile III/*Gimmesoft* ____ **76**
Word Search/*Second City Software* ____ **80**

Departments

Advertisers Index ____ 96
Back Issue Info ____ 94
CoCo Gallery ____ 18
Corrections ____ 49
Letters to Rainbow ____ 4
Intercom ____ 86
Received & Certified 82
Submitting Material ____ 74
Subscription Info ____ 28

Columns

60
Barden's Buffer
William Barden, Jr.
The future of the CoCo

72
BreakPoint
Greg Law
BASIC09 Interfacing

62
CoCo Consultations
Marty Goodman
Just what the doctored ordered

The cassette tape/disk symbols beside features and columns indicate that the program listings with those articles are on this month's RAINBOW ON TAPE and RAINBOW ON DISK. Those with only the disk symbol are not available on RAINBOW ON TAPE.

14
Database Report
Eddie Kuns
Uploads galore

38
KISSable OS-9
Dale Puckett
CoCo 3 does windows

8
Print#-2
Lonnie Falk
Editor's notes

48
Turn of the Screw
Tony DiStefano
Build your own EPROM programmer, Part I

30
Wishing Well
Fred Scerbo
EZ-Thello plays back

95
Wrapping the Rainbow
Cray Augsburg
The tenth round

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Letters to the RAINBOW

The Bond That Holds

Editor:

Sometimes computer users lose sight of the fact that vendors and publishers are businesses. They want to make their clients happy, but they must also pay bills and, unfortunately, must make decisions that don't always please all of the readers. Obviously the cancellation of the New Jersey RAINBOWfest is not the most popular decision, but paying lip service is far easier than voting with one's dollars — I'll bet many of those who are complaining the loudest have never been to a 'fest or economically supported one in any way.

I am responding to those who complain about the magazine's shrinking size and the decision to not have a New Jersey fest. In the face of a dwindling user base THE RAINBOW is the glue that can keep us together. Should it cease publication, the problems currently facing the CoCo Community would likely magnify tenfold. Aimless grumbling and threats of not renewing are not the way to improve things.

Dave Parkes
Ann Arbor, Michigan

Published Again

Editor:

Thank you for publishing my letter in your May 1990 issue. I have received four replies, including three floppy disks. The replies came from as near as Yorktown Heights, New York to as far away as Kansas City, Missouri. I am very pleased with this response, and you can be sure I will continue to read your magazine. Thanks again.

Sidney B. Howie
Carmel, New York

Outstanding 512K Service

Editor:

I want all the readers of THE RAINBOW to know about the outstanding service I received from Performance Peripherals in Mira Loma, California. This is the company that actually makes the 512K upgrade marketed by Microcom.

My CoCo went spazzo when I installed the 512K. Rick at Performance Peripherals came to the rescue. One of the problems was the RAM chips, which he replaced free. He also nailed down an addressing problem that I'd had all along. He was fast, courteous and continually kept me up to date via long distance at his own expense.

There's only one word for this kind of service — outstanding!

Charles Phillips
Laurel Bay, South Carolina

Contributor Response to Contributor Response

Editor:

I was sorry and surprised to read James R. Vann's letter regarding contributor support in your June 1990 issue. I have contributed three programs to THE RAINBOW and personally enjoy responding to letters. Many times readers have asked so many questions that I had to add another stamp on their SASE to return answers to them. I encourage all contributors to support their programs and answer all SASE mail. It is a rewarding experience.

Joel Matthew Hegberg
De Kalb, Illinois

Making Money vs. Saving Money

Editor:

I have just finished reading Cray Augsburg's article "Rainbow Illusions," in the May 1990 issue. The subject matter hits home.

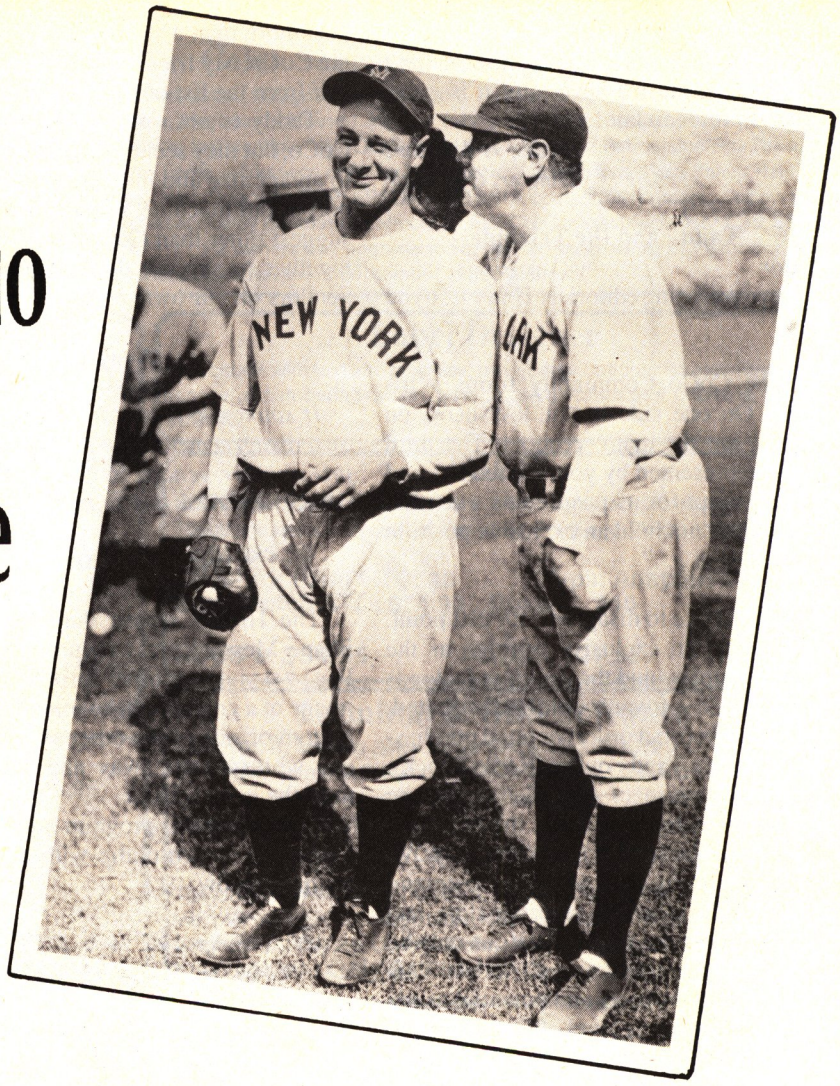
All too often a person makes an investment in equipment (that he or she can afford) just to see the manufacturers throw it aside for something else. It makes you wonder if you should purchase anything else from the manufacturer because your new purchase may be shoved aside like the old discarded product.

Let's face it, the manufacturer is in business to make money, the same stuff we are trying to save. Cray is right; if we don't support it, it isn't going to support us. I have been purchasing from Radio Shack before they were called Radio Shack.

Over the years, I have been slowly accumulating my computer equipment, starting with a CoCo 2 and a cassette recorder. I have improved to a CoCo 3, Multi-Pak Interface, disk drive, printer, 1200-baud modem, etc. I am planning to upgrade my CoCo 3 to 512K, add the second disk drive and a second printer, etc. I've also spent considerable time designing software for a business I plan to start. So you see, all of my hard work and money will be a complete waste if there is no more CoCo support.

In a nutshell, don't give up on the CoCo line of equipment. Support it by buying additional hardware to improve your system (as you can afford it), purchase THE

Buy One Sensational Duo And Get This One Free



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Color Drivers. Next column.

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RAINBOW magazine (or we may not have a RAINBOW magazine). Sometimes we don't appreciate what we have until it is gone, and then it is too late.

Bruce J. Williams
Denver, Colorado

Tandy and the Triangle

Editor:

In your closing editorial of May 1990 you state:

"The CoCo Community forms a triangle. On one side is THE RAINBOW, on another are the many vendors. The third side is represented by you, the readers and users. Except for its position as a vendor, Tandy does not hold an exclusive position in the design . . ."

I would like to disagree with that point. Tandy held an exclusive position as the parent company and the deciding factor as to how CoCo software could be distributed, direct access (mail order) or retail purchasing through a Tandy outlet (Radio Shack). With the demise of *Hot CoCo* and the *Color Computer Magazine*, the only real choices are Radio Shack or THE RAINBOW.

This is going to scare away potential vendors who want to take the time and trouble to design a product that can only be distributed through two small outlets. This also discourages users and potential users. Walk into the lower level of B. Dalton's at 666 Fifth Ave. in New York, and you will see that half of the floor is devoted to computer publications and programs. Not one page or magnetic byte is accessible to the CoCo user. (I buy my copies of THE RAINBOW from the B. Dalton here in Newport, because the one on Fifth Ave. doesn't carry it.) This is enough to make a grown person scream from frustration.

A very good friend of mine bought (on my recommendation) a CoCo 3 as an introduction to home computing. She also bought *Rogue*, *Trivia Fever*, *Robot Odyssey* and *King's Quest III*.

Despite the fact that she bought both computer and software at the same time, no one at Radio Shack pointed out that she needed the 512K upgrade to play *King's Quest-III*. *Rogue* worked, but she couldn't save her position on the disk. *Trivia Fever* did not work at all. (I have since learned that it uses a different version of OS-9, one not supported by the CoCo 3. No one at Radio Shack knew this; I found out on CompuServe).

The crowning touch of the story is that when she went back to get the upgrade she discovered that the Tandy 1000-HX PC-compatible, with monitor and a software package, was on sale for approximately $100 more than a simple 512K upgrade for the CoCo. My friend chose to remove herself from the list of CoCo users.

Tandy is not only not supporting the CoCo, but they seem to go out of their way to antagonize and hinder the use and support of our machine. I don't know what to suggest other than CoCo users must stick together to support this machine and its vendors on our own.

Edward J. Rhodes
Newport, Rhode Island

It sounds like you disagree with your own disagreement. The point is, Tandy is just another vendor as far as support is concerned. Your last sentence says it all.

Screen Dump Surprise

Editor:

The Hi-Res screen dump routine by Shane Messer (THE RAINBOW, May 1989, Page 74) yields another surprise. A mirror image of a graphic can be joined to the top, bottom or side of the other after trimming one white border away and overlapping until the images meet.

Line 150 of this program holds the key. Make one screen dump with each of the changes below:

```
150 FOR Y= 198 to 0 STEP -1
150 FOR Y= 0 to 198 STEP 1
```

Sheridan Wilson
Jamaica, New York

DeskMate Problems

Editor:

I've had a problem with *DeskMate* since I first obtained the program. When I first purchased my CoCo 3, I received a disk containing *DeskMate 3* with the computer. The program would not run. I returned it and was given another copy. This wouldn't run either.

I spoke with a man in a Radio Shack store in Collinsville and was told that there was a bug of some kind in these programs. He took the disk in and gave me a copy of Version 01.00.00. This version runs fine in my machine.

I have a problem with the Paint program, which is all I use from the *DeskMate* package. There is supposed to be three size grades: small, medium and large. It works fine in small size, but when I try to print in medium or large, I have trouble. As the printout is made, a blank line is left between each printed line.

I have used this with a DMP-100 and now with a DMP-107, and I have the same problem. According to the manual this is supposed to work with any printer that allows for condensed and elongated printing.

What is a good program to allow me to make shop drawings with letters and numbers that work efficiently and print the full page or nearly so? I can't afford to start buying programs until I get what I want.

James E. Parsons
2915 Warren Ave.
Granite City, IL 62040

NEC: Not Even Compatible?

Editors:

I have access to an NEC printer, Model PC-8023A-C, but when I hook it up to my CoCo 3, it will not print.

I would like to know if it is compatible with the CoCo 3 and what I need to do to get it to print. I tried setting the switches, but it did not help.

Also, is the printer compatible with any other printer?

David Sekirka
1687 N. Michigan, Lot 106
Plymouth, IN 46563

I'm Driving, but it Won't Run

Editor:

I am driving a DMP-105 with a CoCo 3 but cannot — even with a serial-to-parallel cable and reset external dip switches, etc. — get the printer to run at 2400 baud (which on Page 44 of the printer manual suggests can be managed). Can you help?

Also, I acquired the two original disks and the tutorial for *DeskMate 3*. I cannot get very far past the OS-9 Boot message before the program hangs up.

I admit that my problems could be strictly pilot error, but I have tried and failed to get any help from Tandy regarding either of the above.

Robert L. Willard
1203 East Lakeshore Drive
Carriere, MS 39426

The Prodigal Son

Editor:

A friend of mine sent me an MS-DOS Christmas card, and I decided it was time for me to get into the big league. About this time Tandy came out with their outstanding offer on the 1000 HX. I bought one thinking that, since I was using a double 5¼-inch floppy disk drive with my CoCos I should have a second 3½-inch drive because of the pain of making backup disks with a single drive. About this time I also felt I needed the external 5¼-inch floppy so I could use the MS-DOS items that come on that medium (for one — the original Christmas card).

I received an offer from a west coast distributor offering about $900 worth of MS-DOS items for just $79, which included such items as *WordStar 5.0*, *Logitech Mouse*,

Continued on Page 88

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UPS 2ND DAY AIR

A Bright Horizon

There was some real excitement at RAINBOWfest in Chicago this last April and I think the products we saw bode very well for the Color Computer.

Frank Hogg Laboratory and Kenneth-Leigh Enterprises showed new versions of the CoCo, products which they have indicated to me will be available for sale before the end of the year at the very latest. Gibbs Labs showed a board that allows upgrading as well. I will not go into detail about these products, but I do want to make some general comments about them.

When it was introduced, the Color Computer was just about the most powerful computer available to the public at a moderate price. I compared it to other computer systems and it ran circles around them.

The abilities and capabilities of the Color Computer attracted some major talent to the machine and to the 6809 processor. Tandy, with its huge marketing resources, attracted programmers to the machine, and the health of the market brought others via the third-party route.

What these people had to do was learn 6809 assembly language. Learning *any* assembly language is no easy feat, but is usually necessary if the applications you write are going to be fast enough and good enough to work in the real world.

Others learned to soup up BASIC and do such creative things with it that many users were willing to ignore the slow speed of the programs in order to use the capabilities they had.

So what happened? Tandy brought out the Color Computer 2 and then the Color Computer 3. Both machines were enhanced versions of the original, and both continued to use the 6809.

Because things were done differently, some programs had to be changed as the new computers came out. But programmers did not have to learn a new language.

The companies that make these processors, of course, want to sell as many of them as they can. So, what they do, generally, is keep the same things in each one — let's call them instructions, because that is what they really are called — but add new things. Newer chips can also make a data path wider as well, which means a processor can move, for example, 16 bits of data at a time instead of 8. But the general structure of how you do these things stays the same.

I know precious little about assembly language programming. I do know, however, that the general way to do things is to, for example, store one value in one place, store another in another and then add them together, placing the new value in a third location. These places are specific addresses in memory.

This is not like adding numbers (although it can be), which is why assembly language has always confused me. If you put this sort of value at this sort of address, it does a specific thing to a computer.

The point is as bigger and better processors became available, such as the 68000 family from Motorola (the same manufacturer of the 6809), it was far easier to convert a program to a new processor than, for instance, to convert it from an 8080 from Intel (which makes the processors used in Tandy and compatible PCs).

Those of you who have been with us long enough will remember when Tandy came out with Extended Color BASIC, an enhancement to Color BASIC that came with the original CoCo. What ECB gave us was more commands to use and more things to do with the ones we had. It was easy to rewrite programs for ECB and give them more pizzaz. But, if we decided to write the programs over in, for example, LOGO when it became available, it was like doing the whole thing over again.

The point of all this is that I see the new CoCos as a natural extension of the present CoCo you have. They have more power, more flexibility and are a natural upgrade path for those of you who are interested in having that capability. You can do it today or some time in the future.

I also expect these new machines will bring in, gradually at first, a wide variety of new applications. One of the reasons they will is because the conversion will be easy for most programmers. This is a major plus for all of us.

* * * * *

At least for next year, we have decided to have one large RAINBOWfest rather than two smaller ones as we did this year. The show will be held in Chicago during the spring as it has been for many years.

There are many reasons why we have decided on one show and have decided on Chicago as the site. One of them is that there are several local groups who want to try their hand at some regional meetings, and most of those who have spoken to us are interested in doing so during the fall. Another is that the Hyatt in Chicago has been the "flagship" hotel for our shows for many years, and we have been more successful in keeping room rates down for fest-goers there.

I hope you will support a regional meeting if it is near where you are. But, just as importantly, I hope you will make plans for next spring in Chicago for RAINBOWfest. It will be our 20th show.

— Lonnie Falk

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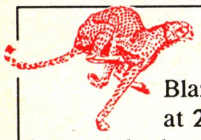

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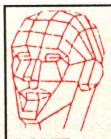
Blazing Fast! Runs at **2 Mhz** and uses the standard text screens for lightning fast execution.



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Word Power 3.3 allows **72K** of workspace on a 128K CoCo and **460K** on a 512K CoCo. More memory than any other word processor. Period.

DISPLAY

Choice of **40** or **80** columns with your choice of colors. Can be used with RGB/ Composite/Monochrome Monitors and TV. Pull down menus, plain english prompts, on-screen underlining and page break display make it a breeze to use!

EDITING

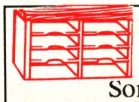
Powerful full-screen editor w/ word-wrap. 4-way cursor,scrolling; Line Positioning; Block Commands; Search, Replace; OOPs recall during delete, adjustable key-repeat, key-click, typeahead, Tabs, Word-Count and much more! . Built-in extensive **HELP** screen can be accessed anytime during edit.

SPOOLER

Print and Edit documents at the same time!

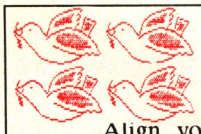
CALCULATOR

Built-in 4 function calculator!



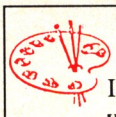
SORTING

Sort lists in a flash!



2 COLUMN PRINTING

Align your text in 2 columns with a few keystrokes!



GRAPHICS

Insert **graphics** in your documents! Allows you to import PMODE 3/4, HSCREEN and CoCo Max II/III pictures!

SPLIT-SCREEN EDITING

Freeze a portion of text and edit another. Its fantastic!

MAIL MERGE

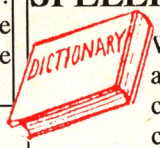
Type a letter, follow it with a list of names & addresses and have Word Power print out personalized letters. Its that easy!

SAVING / LOADING

Creates ASCII files that are compatible with other word-processors, terminal programs, etc. Allows directory point & select for easy loading/saving, **Automatic Backup**, file erase, free space display. **ARE YOU SURE?** prompts prevent accidental deletes. The **Auto-Save** feature automatically saves text to disk during user-defined intervals for peace of mind. Supports double-sided drives.

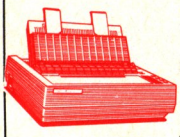
MACROS

Playback up to 250 keystrokes with a single key! Automate multiple tasks with a single key! You'll love it!



SPELLING CHECKER

Word Power 3.3 include a **80,000** word spelling checker which finds and corrects mistakes in your text.

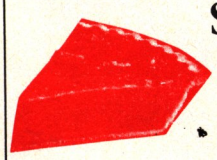


PRINTING

Works with **all** printers that work with the CoCo. Allows options such as baud rates, spacing, page/print pause, partial print, page numbering/ placement, linefeeds, multi-line headers/footers, right justification and number of copies. The values of these options can be changed in the text by embedding Printer Option Codes. The **WHAT YOU SEE IS WHAT YOU GET** feature allows you to preview the text on the screen as it will appear on the printer. You can view margins, page breaks, justification and more.

! PUNCTUATION CHECKER

This checker will proofread your text for punctuation errors such as capitalization, double-words, a/an usage, spaces and more. Its the perfect addition to any word-proccessor.



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UPS 2ND DAY AIR

A BASIC program that teaches you international code flags

CRACKING

by Jay Smith

The international code flag is a nautical alphabet used in the military and in competitive sailing. Code flags are used for a type of communication other than sound because sound alone doesn't suffice when two parties communicate over a long distance (one reason is because of possible misinterpretations). Flags overcome the long-distance problem because light travels further without flaw; therefore, fewer messages are missed.

This program, titled *Code Flag*, performs five tasks:

- Displays 13 code flags for the title page and spells out CoCo code flags.
- Displays all 26 code flags and adjacent to each flag shows the letter it represents.
- When you enter a message of less than 33 characters, the CoCo draws the message without any character representation.
- Includes a quiz that displays a flag and asks the user to identify it.
- Includes an Exit function.

Overall the program is self-explanatory. Any key, including BREAK, advances the computer to the menu. An END option is included so that you can use the BREAK key to return to the menu but still exit the program without pressing ENTER. I strongly suggest a cold poke to erase the program from memory.

While writing this program I used a composite monitor. You may want to make changes to the colors used if you have an RGB monitor. I hope you have fun learning international code flags. ❑

Jay Smith is a student at New Hanover high school in Wilmington. He enjoys sailing and other water sports, as well as programming with his CoCo. He may be contacted at 2802 Park Ave., Wilmington, NC 28403.

THE NAUTICAL CODE

CoCo 3

```
60 ..... 217   1060 ..... 124
126 ..... 1    1170 ..... 92
220 ..... 142  1260 ..... 157
330 ..... 240  1360 ..... 218
460 ..... 191  1450 ..... 121
540 ..... 132  1530 ..... 151
650 ..... 226  1620 ..... 122
770 ..... 254  1720 ..... 108
850 ..... 204  1762 ..... 72
940 ..... 213  END ..... 185
```

The Listing: CODEFLAG

```
5 ON BRK GOTO 40
10 REM TITLE
20 NA$=" COCO CODE      FLAGS":CO
=8:ME$="TITLE":GOTO130
25 HPRINT(INT(X/8)+1,INT((10+Y)/
8)),ABC$:RETURN
30 HPRINT(10,19),"JAY SMITH , 19
89":HPRINT(9,21),"ANY KEY TO CON
TINUE"
31 Q$=INKEY$:IF Q$=""THEN31
40 REM MENU
50 WIDTH40:PRINT:PRINT TAB(18);"
MENU":PRINT:FORX=1TO5:PRINTTAB(1
0)"("X")":NEXTX
60 LOCATE 16,3:PRINT"TITLE SCREE
N":LOCATE 16,4:PRINT"DISPLAY ALL
 FLAGS":LOCATE16,5:PRINT"TYPE A
MESSAGE":LOCATE16,6:PRINT"CODE F
LAG QUIZ":LOCATE16,7:PRINT"END P
ROGRAM"
65 Q$=INKEY$:IF Q$=""THEN 65:ELS
EIF VAL(Q$)>5THEN65:ELSEQ=VAL(Q$
)
70 ON Q GOTO 10,1600,100,1700,20
00
99 REM MESSAGE
100 WIDTH 40:CLS:ME$="MESSAGE"
110 PRINT"INPUT A MESSAGE":PRINT
"UP TO 36 CHARACTERS"
120 INPUT NA$:IF LEN(NA$)>36 THE
N NA$=LEFT$(NA$,36)
125 PRINT"CHOOSE A BACKGROUND CO
LOR":PRINT"  0 = GREEN":PRINT"
2 = BLUE":PRINT"  3 = RED":PRINT
"  4 = WHITE":PRINT"  5 = LIGHT
GREEN":PRINT"  6 = PINK":PRINT"
 8 = BLACK":
126 INPUT CO
130 HSCREEN2
140 HCLSCO
150 FOR F=1TO(LEN(NA$))
160 ABC$=MID$(NA$,F,1)
170 H=ASC(ABC$)-64
180 IF ABC$=" "THEN NEXT
190 ON H GOTO 210,260,300,350,40
0,450,500,550,600,650,700,750,80
0,850,890,940,990,1040,1090,1140
,1190,1240,1290,1340,1390,1440
200 REM ########## A ##########
210 A$="U20;R20;G1;D2;G1;D2;G1;D
2;G1;F1;D2;F1;D2;F1;D2;F1;L20;R1
0;U20"
220 GOSUB1480
230 HPAINT(X+1,Y-1),4,1:HPAINT(X
+11,Y-1),2,1
240 GOTO 1550
250 REM ########## B ##########
260 A$="U20;R20;G1;D2;G1;D2;G1;D
2;G1;F1;D2;F1;D2;F1;D2;F1;L20"
270 GOSUB1480
280 HPAINT(X+1,Y-1),6,1:GOTO 155
0
290 REM ########## C ##########
300 A$="U20;R20;D20;L20;U4;R20;U
4;L20;U4;R20;U4;L20"
310 GOSUB1480
320 HPAINT(X+1,Y-1),2,1:HPAINT(X
+1,Y-6),4,1:HPAINT(X+1,Y-10),6,1
:HPAINT(X+1,Y-14),4,1:HPAINT(X+1
,Y-17),2,1
330 GOTO 1550
340 REM ########## D ##########
350 A$="U20;R20;D20;L20;U6;R20;U
8;L20"
360 GOSUB 1480
370 HPAINT(X+1,Y-1),1,1:HPAINT(X
+1,Y-7),2,1:HPAINT(X+1,Y-16),1,1
380 GOTO 1550
390 REM ########## E ##########
400 A$="U20;R20;D20;L20;U10;R20"
410 GOSUB1480
420 HPAINT(X+1,Y-1),6,1:HPAINT(X
+1,Y-11),2,1
430 GOTO 1550
440 REM ########## F ##########
450 A$="U20;R20;D20;L20;U10;E10;
F10;G10;H10"
460 GOSUB 1480
470 HPAINT(X+1,Y-1),4,1:HPAINT(X
+13,Y-1),4,1:HPAINT(X+13,Y-18),4
,1:HPAINT(X+1,Y-18),4,1:HPAINT(X
+11,Y-10),6,1
480 GOTO 1550
490 REM ########## G ##########
500 A$="U20;R20;D20;L20":GOSUB14
80:HPAINT(X+1,Y-1),2,1:A$="R3;U2
0;R4;D20;R2;U20;R4;D20;R2;U20;R5
"
510 GOSUB 1480
520 HPAINT(X+1,Y-1),1,1:HPAINT(X
+8,Y-1),1,1:HPAINT(X+14,Y-1),1,1
530 GOTO 1550
540 REM ########## H ##########
550 A$="U20;R20;D20;L20;R10;U20"
```

```
560 GOSUB1480
570 HPAINT(X+1,Y-1),4,1:HPAINT(X
+11,Y-1),6,1
580 GOTO 1550
590 REM ########## I ##########
600 A$="U20;R20;D20;L20"
610 GOSUB1480
620 HCIRCLE(X+10,Y-10),6,1:HPAIN
T(X+1,Y-1),1,1:HPAINT(X+10,Y-10)
,10,1
630 GOTO 1550
640 REM ########## J ##########
650 A$="U20;R20;D20;L20;U7;R20;U
6;L20"
660 GOSUB 1480
670 HPAINT(X+1,Y-1),2,1:HPAINT(X
+1,Y-8),4,1:HPAINT(X+1,Y-16),2,1
680 GOTO 1550
690 REM ########## K ##########
700 A$="U20;R20;D20;L20;R10;U20"
710 GOSUB 1480
720 HPAINT(X+1,Y-1),1,1:HPAINT(X
+11,Y-1),2,1
730 GOTO 1550
740 REM########## L ##########
750 A$="U20;R20;D20;L20;U10;R20;
U10;L10;D20"
760 GOSUB 1480
770 HPAINT(X+1,Y-1),10,1:HPAINT(
X+11,Y-1),1,1:HPAINT(X+1,Y-11),1
,1:HPAINT(X+11,Y-11),10,1
780 GOTO 1550
790 REM########## M ##########
800 A$="U20;R20;D20;L20;U3;E7;H7
;U3;R3;F7;E7;R3;D3;G7;F7;D3;L3;H
7;G7"
810 GOSUB1480
820 HPAINT(X+1,Y-5),2,1:HPAINT(X
+19,Y-5),2,1:HPAINT(X+10,Y-19),2
,1:HPAINT(X+10,Y-1),2,1:HPAINT(X
+10,Y-10),4,1
830 GOTO 1550
840 REM ########## N ##########
850 A$="U20;R20;D20;L20":GOSUB14
80:HPAINT(X+1,Y-1),2,1:A$="U5;R2
0;U5;L20;U5;R20;U5;L5;D20;L5;U20
;L5;D20":GOSUB1480
860 HPAINT(X+1,Y-1),4,1:HPAINT(X
+11,Y-1),4,1:HPAINT(X+6,Y-6),4,1
:HPAINT(X+16,Y-6),4,1:HPAINT(X+1
,Y-11),4,1:HPAINT(X+11,Y-11),4,1
:HPAINT(X+6,Y-16),4,1:HPAINT(X+1
6,Y-16),4,1
870 GOTO 1550
880 REM ########## O ##########
890 A$="U20;R20;D20;L20;U20;F20"
900 GOSUB1480
910 HPAINT(X+2,Y-1),1,1:HPAINT(X
+19,Y-19),6,1
920 GOTO 1550
930 REM ########## P ##########
940 A$="U20;R20;D20;L20;R7;BU7;R
6;U6;L6;D6"
950 GOSUB 1480
960 HPAINT(X+1,Y-1),2,1:HPAINT(X
+10,Y-10),4,1
970 GOTO1550
980 REM ########## Q ##########
990 A$="U20;R20;D20;L20"
1000 GOSUB1480
1010 HPAINT(X+1,Y-1),1,1
1020 GOTO1550
1030 REM ########## R ##########
1040 A$="U20;R20;D20;L20;U8;R8;D
8;R4;U8;R8;U4;L8;U8;L4;D8;L8"
1050 GOSUB 1480
1060 HPAINT(X+1,Y-1),6,1:HPAINT(
X+1,Y-19),6,1:HPAINT(X+19,Y-1),6
,1:HPAINT(X+19,Y-19),6,1:HPAINT(
X+10,Y-10),1,1
1070 GOTO 1550
1080 REM ########## S ##########
1090 A$="U20;R20;D20;L20;R7;BU7;
R6;U6;L6;D6"
1100 GOSUB 1480
1110 HPAINT(X+1,Y-1),4,1:HPAINT(
X+10,Y-10),2,1
1120 GOTO 1550
1130 REM ########## T ##########
1140 A$="U20;R20;D20;L20;R7;U20;
R6;D20;R6;U20"
1150 GOSUB 1480
1160 HPAINT(X+1,Y-1),6,1:HPAINT(
X+10,Y-1),4,1:HPAINT(X+15,Y-1),2
,1
1170 GOTO 1550
1180 REM ########## U ##########
1190 A$="U20;R20;D20;L20;R10;U20
;R10;D10;L20"
1200 GOSUB 1480
1210 HPAINT(X+1,Y-1),4,1:HPAINT(
X+1,Y-19),6,1:HPAINT(X+19,Y-1),6
,1:HPAINT(X+19,Y-19),4,1
1220 GOTO 1550
1230 REM ########## V ##########
1240 A$="U20;R20;D20;L20;R3;E7;F
7;R3;U3;H7;E7;U3;L3;G7;H7;L3;D3;
F7;G7"
1250 GOSUB1480
1260 HPAINT(X+1,Y-5),4,1:HPAINT(
X+19,Y-5),4,1:HPAINT(X+10,Y-1),4
,1:HPAINT(X+10,Y-19),4,1:HPAINT(
X+10,Y-10),6,1
1270 GOTO 1550
1280 REM ########## W ##########
1290 A$="U20;R20;D20;L20":GOSUB1
480:A$="BR4;BU4;U12;R12;D12;L12"
:GOSUB1480:A$="BR7;BU7;U6;R5;D6;
L5"
1300 GOSUB 1480
1310 HPAINT(X+10,Y-1),2,1:HPAINT
(X+10,Y-5),4,1:HPAINT(X+10,Y-9),
6,1
1320 GOTO 1550
1330 REM ########## X ##########
1340 A$="U20;R20;D20;L20;R8;U8;L
8;U4;R8;U8;R4;D8;R8;D4;L8;D8"
1350 GOSUB 1480
1360 HPAINT(X+1,Y-1),4,1:HPAINT(
X+1,Y-18),4,1:HPAINT(X+19,Y-1),4
,1:HPAINT(X+19,Y-18),4,1:HPAINT(
X+10,Y-10),2,1
1370 GOTO 1550
1380 REM ########## Y ##########
1390 A$="U20;R20;D20;L20":GOSUB1
480:HPAINT(X+1,Y-1),6,1:A$="U16;
E4;R4;G8;D4;E12;R4;G16;D4;E20;D4
;G16;R4;E12;D4;G8;R4;E4"
1400 GOSUB 1480
1410 HPAINT(X+1,Y-4),1,1:HPAINT(
X+1,Y-12),1,1:HPAINT(X+1,Y-18),1
,1:HPAINT(X+8,Y-1),1,1:HPAINT(X+
16,Y-1),1,1
1420 GOTO 1550
1430 REM ########## Z ##########
1440 A$="U20;R20;D20;L20;E20;D20
;H20"
1450 GOSUB 1480
1460 HPAINT(X+10,Y-1),6,1:HPAINT
(X+10,Y-19),1,1:HPAINT(X+1,Y-10)
,10,1:HPAINT(X+19,Y-10),10,1
1470 GOTO 1550
1480 IF ME$="DISPLAY"THEN1530:EL
SE IF F<13 THEN Y=40
1490 IF F>12 AND F<25 THEN Y=110
1500 IF F>24 THEN Y=180
1510 G=F:IF Y=110 THEN G=G-12:EL
SEIF Y=180 THEN G=G-24
1520 X=1+(G-1)*25
1525 IF ME$="QUIZ" THEN HDRAW "B
M176,110"+A$:X=176:Y=110
1530 HDRAW"BM"+STR$(X)+","+STR$(
Y)+A$
1540 RETURN
1550 REM
1560 IF ME$="QUIZ" THEN 1730
1564 IF ME$="DISPLAY"THEN1640
1565 IF ME$="TITLE"THENGOSUB25
1566 IF LEN(NA$)=F THEN 1580
1570 NEXT
1580 IF ME$="TITLE"THEN30
1590 IF ME$="MESSAGE"THENQ$=INKE
Y$:IF Q$=""THEN GOTO 1590:ELSE G
OTO 40
1600 REM DISPLAY
1610 ME$="DISPLAY":HSCREEN2:HCLS
2
1619 S=1:T=0:
1620 FOR R=1TO6:HPRINT(S,4*(R-1)
+1),CHR$(64+R+T):NEXT R:T=T+6:S=
S+7:IFS=29THEN 1623
1621 GOTO 1620
1623 FOR R=1TO2:HPRINT(29,4*(R-1
)+1),CHR$(R+88):NEXT R
1626 FOR S=1TO5
1630 FOR G=1TO6:X=20+(S-1)*55:Y=
21+(G-1)*32
1635 H=(S-1)*6+G:IFH=27THEN1660:
ELSEGOTO 190
1640 NEXT G:NEXTS
1660 Q$=INKEY$:IFQ$=""THEN1660
1675 GOTO 40
1700 REM QUIZ
1705 ME$="QUIZ"
1710 D=RND(26)+64:H=D-64:O=0
1715 HSCREEN2:HCLS2
1720 GOTO 190
1730 REM
1740 HPRINT(15,10),"WHAT IS THIS
 LETTER?"
1750 K$=INKEY$:IF K$=""THEN1750:
ELSE IF K$=CHR$(H+64)THENGOTO 17
70
1752 O=O+1
1755 IF O>1THEN1760:ELSE HPRINT(
15,16),"WRONG, TRY AGAIN":GOTO 1
750
1760 HPRINT(1,17),"WRONG AGAIN!
THE CORRECT LETTER IS "+CHR$(H+6
4):HPRINT(25,18),"ANOTHER?"
1762 O$=INKEY$:IF O$=""THEN 1762
:ELSE IF O$="Y"THEN 1700:ELSE GO
TO 40
1770 HPRINT(15,18),"CORRECT!   A
NOTHER?"
1772 O$=INKEY$:IF O$=""THEN 1772
:ELSE IF O$="Y"THEN 1700:ELSE GO
TO 40
2000 REM END (SLOW DOWN POKE)
2010 WIDTH32:END
4):HPRINT(25,18),"ANOTHER?"
1762 O$=INKEY$:IF O$=""THEN 1762
:ELSE IF O$="Y"THEN 1700:ELSE GO
TO 40
1770 HPRINT(15,18),"CORRECT!   A
NOTHER?"
1772 O$=INKEY$:IF O$=""THEN 1772
:ELSE IF O$="Y"THEN 1700:ELSE GO
TO 40
2000 REM END (SLOW DOWN POKE)
2010 WIDTH32:END
```

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Uploads Galore!

by Eddie Kuns
CoCo SIG Database Assistant

General Information (in the OS-9 SIG): Mike Woolley (WOOLLEY) submitted his `helpmsg` file, which, when used with the `help` command, saves you the trouble of merging help files together. **Kelly Thompson** (KMTHOMPSON) contributed a file for those contemplating using OS-9. **Frances Calcraft** (FRANCALCRAFT) posted a collection of useful OS-9 information and a list of uses for a RAM disk. **Greg Jandl** (DAMIONGREY) uploaded a description of the LZW data compression algorithm and how it relates to the GIF graphics format.

Applications: Bruce Moore (THUNDERFNGRS) contributed a BASIC09 program to design speaker enclosures. **Paul Tesch** (PAULTESCH) posted a version of **Dick White**'s (DICKWHITE) *DynaCalc* Form 1040, updated for the 1989 tax year. **Phillip Brown** (THEFERRET) released Version 1.4 of his pop-up calculator that fixes a couple of bugs and allows larger hex numbers. He also posted a simple text formatter. **Jeff Blower** (SEBJMB) released a preliminary release of `SMenu`, an alternative to *MultiVue*'s `GShell`. BASIC09 source is included.

Utilities: Christian Michaud (SUPERCHRIS) submitted `colordmp`, a color graphics dump program for the Star NX-1000 Rainbow printer. **Ken Lindsay** (KLINDSAY) released Version 3 of a `copy` command that accepts wildcards. He also uploaded a version of `dir` that supports *Shell+*'s wildcards. This program lists the files in an entire directory tree and sorts a directory into alpha-numeric order. **Zack Sessions** (ZACKSESSIONS) contributed a replacement for the stock Tandy `makdir` command and an improved version of **Jim McDowell**'s (JMLSOFT) *RSSave* utility, which is a `dsave`-like utility that copies to and from RS-DOS formatted disks. **John Beveridge** (JOHNTORONTO) released a corrected version of Frans Lichtenberg's *QTip*, Version 1.93. John has also posted a redated *CoCoBin* that's easier to find. It removes extra information uploaded in the CoCoBin format so you can access it normally if you downloaded it without using CoCoBin.

Telcom: Kelly Thompson posted a shell script for *OSTerm* that loads all of the *OSTerm* modules, sets up the menu colors and allows you to send CONTROL-C and BREAK through the modem. **John Morris** (JOHNMORRIS) contributed a fast quote-of-the-day generator for BBSs, including a file containing a couple hundred quotes. Ken Lindsay released the latest version of **Bill Brady**'s (OS9UGED) *WizAcia* driver patched to work with the Eliminator. This version fixes the bug that causes the Eliminator's disk driver to hang during disk accesses.

Graphics & Music: Alex Kiefer (853624) submitted the BASIC09 game *Starlanes* that runs under *Multi-Vue*. **Mike Schneider** (MSCHNEIDER) uploaded ten digitized sound files from the movie "Heathers." Kelly Thompson contributed a humorous VEF picture of weird window bugs and an *UltiMusE* version of Beethoven's "Moonlight Sonata." **John Kou** (BAMBOO) uploaded newer, longer versions of a number of *UltiMusE* songs he's previously posted as well as five Christian piano songs, all for *UltiMusE* Version 4.5. **Ron Morelli** (AUTOTECH) submitted "Fame" and the theme from the movie "Superman." *Paul Duncan* (PDUNC) posted one of Bach's 3-part inventions. *Hadley Hazen* (HAZE) contributed three songs from "King of Kings" as well as "Hymne" by Vangelis.

Programmers Den: John Farrar (TRIX) posted a C program to return the codes each key generates. The `inkey()` function serves the same function as BASIC09's `inkey()` function, but is written in C. **Mike Shook** (MISHOO) contributed a program to split large text files into smaller files. This is useful if you have a large text file that is too large to fit in your editor's buffer.

CoCo SIG

CoCo 3 Graphics: Richard Trasborg (TRAS) uploaded more than one dozen IMG pictures including several of Victoria Principal and some 16-level gray-scale pictures of Shannon Tweed. **James Farmer** (MODEMMASTER) submitted six Rascan pictures from the Somerset RAINBOWfest, including pictures of Burke & Burke, Chris Hawks, Tom de Marco, Pete Ellison, Glen Dahlgren and himself. **Eric M. Ordway** (EMO) contributed five CM3 sports pictures traced from newspaper photos with the X-Pad and edited with *CoCo Max III*.

Utilities & Applications: Wayne Robbins (WAYNEROBBINS) posted a utility to give a disk directory three columns in a width-40 screen and five columns in a 80 column screen. **Bryan Stephens** (BRSTEPHENS) released a rewrite of *Ledger3*. He cleaned up the programming and moved it to a width-80 screen rather than an HSCREEN. This version runs faster and uses a 28-line screen.

Hardware Hacking: Marty Goodman (MARTYGOODMAN) contributed a complete description of the specifications and storage capacities of the various MS-DOS disk formats in common usage. He also contributed a single-page listing of the pinouts of common EPROMs and ROMs of all sizes, from 64K to 8-Megabit EPROMs including the 23100 and similiar 1-Megabit ROMs.

Product Reviews & Announcement: Scott Corley (SCOTTJ) uploaded a set of demo programs for *Utili-Comm*.

Eddie Kuns is pursuing a PhD in physics at Rutgers University. He lives in Aurora, Illinois and works as a programmer and researcher at Fermilab. Eddie is co-manager of the CoCo SIG; his username is EDDIEKUNS.

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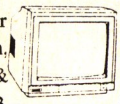

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Michael is a restaurant manager and also attends art school. He has a bachelor's degree in art education. He drew this picture on his CoCo 3 just two days after purchasing *CoCo Max III*. Michael lives in Miami.

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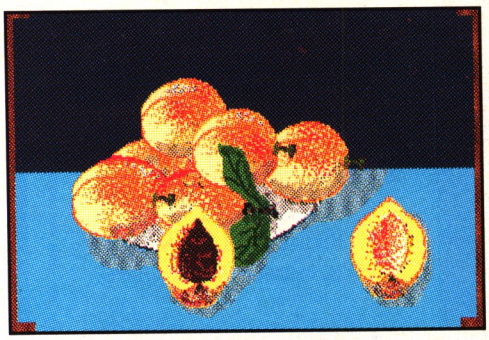
James J. Gibbons

As a professional artist and teacher, James uses a variety of graphics programs including *The Rat*, *Micro-Illustrator*, *Sketch*, *The Color Computer Artist*, *CoCo Max II* and *CoCo Max III*, which was used for this scene. He plans to continue working in this field until his pictures look like paintings. James lives in Watsontown, Pennsylvania.

3rd Place



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A software technique that eliminates the cartridge-interrupt problem

CoCo 3 GIME CART* IRQs Explained

by Bruce Isted

The November 1989 issue of THE RAINBOW contained an article by Marty Goodman titled "The OS-9 *CART Interrupt Fix," describing hardware modifications for the CoCo 3 to eliminate the so-called lost cartridge interrupt problem. While the CoCo 3 IRQ hacks described in that article work, they are not required; although if more than one interrupt-driven device is used in a Multi-Pak Interface, some sort of IRQ hack is still required in the Multi-Pak Interface. This article describes a software technique that also eliminates the lost-interrupt problem and doesn't require any hardware modifications. If your CoCo 3 has already been modified with one of the IRQ hacks, these software modifications won't make any difference. They will neither help nor hinder cartridge interrupts. Some third-party software already makes use of this software technique. Examples include Kevin Darling's no-halt Disto floppy drivers, Bill Brady's WIZACIA driver and my Eliminator clock modules.

As Marty's article says, stock OS-9 Level II, Version 2.00.01, for the CoCo 3 doesn't handle cartridge interrupts properly. This article specifically addresses the proper handling of the GIME's CART* (cartridge interupt) and other interrupt inputs under the OS-9 Level II operating system. The general technique is applicable to any CoCo 3 interrupt-driven software that runs under BASIC as well.

Figure 1 defines the bits in the GIME's

```
Bit 7 - Unused
Bit 6 - Unused
Bit 5 - Timer Interrupt
Bit 4 - Horizontal Border (video) Interupt (HSYNC)
Bit 3 - Vertical Border (video) Interrupt (VSYNC)
Bit 2 - Serial Data Interrupt
Bit 1 - Keyboard Interrupt
Bit 0 - Cartridge Interrupt (CART*)
```

Figure 1: Register Bit Definitions

```
00) set up IRQ service routine to enter at Step 06
01) read GIME IRQ enable register copy
02) set appropriate GIME IRQ enable bit(s)
03) save GIME IRQ enable register copy
04) enable desired GIME IRQs
05) continue normal operations while waiting for IRQ
      Note:  Step 06 is not executed until IRQ is received.
06) if (and only if) IRQ, read GIME IRQ status register
07) combine data from old GIME IRQ status copy and new GIME IRQ status
08) save GIME IRQ status register copy for other IRQ driven devices
09) check IRQ driven devices, if none need service go to Step 13
10) service IRQ driven device (must clear device's IRQ)
11) clear appropriate GIME IRQ status copy bit(s)
12) go to Step 08
13) disable GIME cartridge interrrupt
14) enable GIME cartridge interrupt
15) exit IRQ service, return to normal operation at Step 05
```

Figure 2: GIME IRQ Handling Pseudocode

Bruce Isted is a self-taught programmer, hardware hacker and computer telecommunications junkie who is vice president of the OS-9 Users Group. He may be contacted at 527 Lake Newell Cr., SE, Calgary, Alberta T2J 3L7, Canada.

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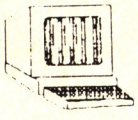

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IRQ enable (write $FF92), IRQ status (read $FF92), FIRQ enable (write $FF93), and FIRQ status (read $FF93) registers. When an IRQ or FIRQ enable bit is clear (0), the corresponding interrupt input is disabled; and when the IRQ/FIRQ enable bit is set (1), the interrupt input is enabled. When an IRQ or FIRQ status bit is clear (0), the corresponding source isn't generating an interrupt service request; when the IRQ/FIRQ status bit is set (1), the interrupt source is making an interrupt service request. Reading the GIME's IRQ or FIRQ status register causes all GIME IRQ or FIRQ flag bits to be cleared and the GIME's IRQ or FIRQ to be released immediately afterward. When enabled, the GIME's CART* input is only activated by a high-to-low signal transition, which makes it what is commonly called an edge-triggered input. The function of the IRQ and FIRQ enable/status registers is similar except for the type of interrupt generated. For the purposes of this article I'll limit further discussion to the IRQ enable/status register.

```
00) read GIME IRQ status register
01) combine new GIME IRQ status with old GIME IRQ status copy
02) save new GIME IRQ status register copy
03) if VSYNC IRQ, go to Step 06
04) set up OS-9's IRQ poll subroutine
05) exit clock module, jump into OS-9's IRQ service routine
        Note: IRQ handling continues but doesn't return to clock until the next IRQ.
06) increment OS-9 system's time variables (software clock)
07) set up clock module's VIRQ poll routine at Step 09
08) exit clock module, jump into OS-9's IRQ service routine
        Note: IRQ handling returns to clock at Step 09
09) GIME IRQ status register copy checked, if IRQ(s) set V/IRQ flag
10) VIRQ counter(s) decremented, if VIRQ(s) set V/IRQ flag
11) if V/IRQ flag is clear, go to Step 14
12) call OS-9's IRQ poll subroutine
13) if valid IRQ or VIRQ was serviced, go to Step 12
14) call keyboard/joystick check subroutine
15) if time alarm, issue alarm signal or BELL
16) exit clock module, jump into OS-9's time slice routine
        Note: IRQ handling continues but doesn't return to clock until the next IRQ.
```

Figure 3: Clock Module IRQ Pseudocode

To refresh your memory, OS-9 Level II sometimes appears to lose a cartridge interrupt, which typically causes an OS-9 program to hang or freeze up. The interrupt is not really lost but is ignored by the GIME chip. There appear to be two possible scenarios that can cause this condition.

The first scenario occurs when only the VSYNC (vertical sync) and a single cartridge interrupt device are active. What probably happens is that the cartridge interrupt device issues an IRQ at almost precisely the same instant as the GIME's IRQ status register is read in response to a VSYNC IRQ. The VSYNC IRQ is serviced, but the cartridge interrupt is ignored because the GIME's CART* status flag bit is not set during the status read and doesn't get set afterward either. Since the CART* device hasn't been serviced, the GIME's CART* input is held low and the cartridge interrupt is ignored.

The second scenario occurs when there are two or more interrupt-driven devices connected to the GIME's CART* input. Occasionally two or more devices may issue interrupts almost simultaneously, and the higher priority device is serviced while the lower priority device is ignored. Since the second device holds the GIME's CART* input low, the second device and any other subsequent device's cartridge interrupts are not serviced.

The Solution

The solution is built into the GIME but

Glossary of Terms

CART* - Cartridge Interrupt. This signal is routed through the GIME chip and informs the processor that a cartridge device needs processing, usually because of incoming data. This signal is also used by ROM Paks to cause the program to auto-execute.

FIRQ - Fast Interrupt Request. This interrupt functions similarly to an IRQ except that only the program counter and condition codes registers are saved on the stack.

GIME - Graphics/Interrupt/Memory Enhancer. The large, square chip in the Color Computer 3 that is responsible for handling video, graphics, memory management, and interrupts from hardware devices.

HSYNC IRQ - Horizontal Sync Interrupt. An interrupt generated by the GIME chip at the start and end of a video scan-line.

Interrupt - A signal that, when activated, causes the hardware to transfer control to a specific location in memory. After the interrupt has been processed, control is returned to the interrupted program.

IRQ - Interrupt Request. An interrupt generated by a hardware device. All registers are saved on the stack before control is transferred to the interrupt handler.

NMI - Non-Maskable Interrupt. This interrupt is similar to an IRQ except that it cannot be masked or ignored.

Pseudocode - An intermediate form of writing program instructions in an English-like language instead of a real programming language so that programming logic can be checked more easily.

Shadow Register - Most of the registers in the GIME chip are write-only. For this reason OS-9 copies the values written to these registers to the direct page area. This duplicate register is often referred to as a shadow register because they are written to the same address with the upper eight bits masked. That is, any data written to $FF92 is also written to $0092 to maintain a readable copy.

System Map - The 64K address space used by the OS-9 Kernel to store the direct page variables, module directory, process descriptors, device drivers, and other system modules.

VIRQ - Virtual Interrupt. A software interrupt that is generated by the clock module at user-specified intervals. This interrupt is commonly used by the floppy disk controller as the motor on and motor off timer.

VSYNC IRQ - Vertical Sync Interrupt. An interrupt generated by the GIME chip at the start and end of a video screen. This interrupt is also used by the clock module as the 50Hz and 60Hz clock-tick used for timekeeping, task switching and other timing related events.

```
00) read GIME IRQ status register
01) combine new GIME IRQ status with old GIME IRQ status copy
02) save GIME IRQ status register copy
03) if VSYNC IRQ, go to Step 06
04) set up clock module's new IRQ poll subroutine at Step 18
05) exit clock module, jump into OS-9's IRQ service routine
      Note: IRQ handling returns to clock at Step 18
06) increment OS-9 system's time variables (software clock)
07) set up clock module's VIRQ poll routine at Step 09
08) exit clock module, jump into OS-9's IRQ service routine
      Note: IRQ handling returns to clock at Step 09
09) GIME IRQ status register copy checked, if IRQ(s) set V/IRQ flag
10) VIRQ counter(s) decremented, if VIRQ(s) set V/IRQ flag
11) if V/IRQ flag is clear, go to Step 14
12) call clock's IRQ poll subroutine at Step 18
13) go to Step 15 (avoid toggling GIME CART* again)
14) call clock's GIME CART* toggle subroutine at Step 20
15) call keyboard/joystick check as subroutine
16) if time alarm, issue alarm signal or BELL
17) exit clock module, jump into OS-9's time slice routine
      Note: IRQ handling continues but doesn't return to clock until the next IRQ.
18) call OS-9's IRQ poll subroutine
19) if valid IRQ or VIRQ was serviced, go to Step 18
20) read old GIME IRQ status register copy
21) clear CART* flag bit in GIME IRQ status register copy
22) save new GIME IRQ status register copy
23) disable GIME CART* IRQ
24) enable GIME CART* IRQ
25) return to caller
```

Figure 4: Modified Clock Module Pseudocode

wasn't generally known until January 1988, when Kevin Darling posted his GIME IRQ/FIRQ findings on several forums. While the GIME CART* input is edge-triggered after it is enabled, it also responds to a low CART* input level as it is enabled. This means that to check for a lost cartridge interrupt, all you have to do is briefly disable, then re-enable the GIME's CART* input. I call this a GIME CART* toggle. If a cartridge device has an interrupt waiting to be serviced, the GIME CART* toggle allows the GIME to generate a CART* interrupt, which restores normal operation.

After extensive experimentation, Kevin Darling, myself and others determined that if the pseudo-code description of GIME IRQ handling shown in Figure 2 is adhered to, then cartridge interrupts will be reliable:

It is important that the GIME IRQ status register be read only once at the beginning of the IRQ service routine, and all interrupts be serviced before the GIME CART* toggle is done. The GIME CART* toggle should only be performed once for every time the GIME's IRQ status register is read. At this time it appears that only the GIME CART* IRQ should be toggled. Experiments have shown that toggling some of the other bits may result in extra (unwanted) IRQs being generated or in other cases ignored.

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The Details

The original OS-9 Level II Version 2.00.01 `clock` modules install themselves into the CoCo 3's IRQ routine such that IRQs pass program control to the `clock` module. A brief pseudo-code description of that module's IRQ operation is shown in Figure 3.

The modifications to the `clock` module consist of installing a GIME CART* toggle subroutine, fixing a minor error-reporting bug that has nothing to do with CART* interrupts, and inserting new instructions that directly or indirectly branch to the GIME CART* toggle subroutine. The resulting pseudo-code description of the modified `clock` module's IRQ operation is shown in Figure 4.

It is the responsibility of the device driver's initialization routine to enable the GIME CART* IRQ and update the shadow register in the direct page. Apart from this initialization, the device driver should never access the GIME's IRQ enable/status registers or the shadow registers.

The Fix

That covers the theory. The rest of this article is devoted to putting the above into practice. A swatch of OS-9 assembly code is provided as an example of the `clock`'s GIME CART* toggle. A BASIC09 patch utility and patch files for the OS-9 Level II `clock` modules (both 50 Hz and 60 Hz versions) are provided. These are the only parts of the operating system that require the GIME CART* toggle modification. Also provided is a patch file for the OS-9 Level II `init` module that allows the patched `clock` modules to work correctly with programs such as *Flight Simulator II*, *King's Quest III*, *Leisure Suit Larry* and any others that use VIRQ (virtual interrupts) in addition to the one used by `cc3disk`. CoCo 3 software packages that run under BASIC and use cartridge interrupts need to be modified individually if they don't already use these techniques.

Listing 1 is a fragment of assembly source code that performs the GIME CART* toggle. It is used in the modified OS-9 Level II `clock` modules. Please note that the assembly source code fragment in Listing 1 is only used when the CoCo 3's IRQs are masked (disabled) as they are inside OS-9's IRQ service routines. Also note that OS-9 Level II maintains the IRQ enable shadow register at $0092 in the system's address map, since the IRQ enable register at $FF92 is write only. If you read from $FF92, you get the IRQ status register rather than what you've written into the IRQ enable register. User programs should never directly manipulate hardware in this manner and should never need to access this information. Any interrupt-driven software that runs under BASIC is free to maintain its own copy of the GIME IRQ enable register as it chooses.

Listing 2 is a BASIC09 procedure called `filepatch` that allows files to be patched in a manner similar to the `modpatch` program supplied with OS-9. The main difference is that it allows insertion and deletion type patches not supported by `modpatch`. `filepatch` is limited to single-module files that are a maximum of 23,552 bytes (23K) in length due to memory constraints and the way the program works. For best results `filepatch` should be loaded into BASIC09 and packed into a module in your `CMDS` directory before it is used. BASIC09 or `runb` (BASIC09's run-time module) and `syscall` (BASIC09's system call subroutine module) must also be in your `CMDS` directory or in memory before `filepatch` can be used. Type `filepatch ("-?")` and press ENTER to display the help screen. See your OS-9 manuals for more information on BASIC09, `runb` and `syscall`.

Listings 3, 4 and 5 are patch files for unmodified CoCo 3 OS-9 Level II Version 2.00.01 50 Hz `clock`, 60 Hz `clock` and `init` modules, respectively. The original modules called `clock.50hz`, `clock.60hz` and `init` are found on the Boot/Config/BASIC09 disk in the `MODULES` directory. Don't make these (or any) patches on the original disk; work on a backup disk. Assuming all files are in the current data directory, the `filepatch` command lines would look like this:

```
filepatch ("clock50.ptc","clock.
50hz","clock.50new")
filepatch ("clock60.ptc","clock.
60hz","clock.60new")
filepatch ("init.ptc","init","In
it.new")
```

After `filepatch` finishes, you should copy the `clock.50new`, `clock.60new` and `init.new` files into your `MODULES` directory as `clock.50hz`, `clock.60hz` and `init`, respectively. Then use `os9gen` or `config` to make a new boot disk using the appropriate patched `clock` module and the patched `init` module.

Miscellaneous

The rumoured OS-9 Level II upgrade is supposed to have the GIME CART* toggle incorporated into the `clock` module, as well as the other fixes that have been mentioned. Until such time as this rumoured upgrade is available, the patched `clock` modules should tide over everyone who uses the software clock. I don't know if any third-party real-time clock modules other than those provided with my Eliminator system incorporate the GIME CART* toggle.

The information I've provided should be sufficient to allow all third-party developers to make use of the GIME CART* toggle. ❑

OS-9 Level II

Listing 1: `irqpoll.asm`

```
D.Poll   equ   $0026       contains OS-9's IRQ poll routine address
D.IRQER  equ   $0092       OS-9's GIME IRQ Enable register copy address
D.IRQS   equ   $00AF       OS-9's GIME IRQ Status register Shadow address
IRQEnR   equ   $FF92       GIME IRQ Enable register address

IRQPoll  jsr   [D.Poll]    do OS-9's regular IRQ poll
         bcc   IRQPoll     until no more IRQs...
GToggle  lda   #%11111110  mask to keep all but CART* flag bit
         anda  <D.IRQS     clear old CART* IRQ Shadow flag bit
         sta   <D.IRQS     save updated Shadow register
         lda   <D.IRQER    get GIME IRQ Enable register copy
         tfr   a,b         copy it for re-enable later
         anda  #%11111110  clear CART* bit
         sta   >IRQEnR     disable GIME CART* IRQs
         stb   >IRQEnR     enable GIME CART* IRQs
         clrb              clear [CC] Carry bit (no error)
         rts               return to caller
```

Listing 2: FilePatch

```
PROCEDURE FilePatch
 0000       (* Written by Bruce Isted. *)
 001D       (* Copyright (C) 1990 Falsoft Inc. *)
 0042       (* File based "patch" utility similar to ModPatch. *)
 0077       BASE 0
 0079       PARAM ptcfile,oldfile,newfile:STRING[80]
 008D       TYPE registers=cc,a,b,dp:BYTE; x,y,u:INTEGER
 00B2       DIM regs:registers
 00BB      DIM callcode,crc(3),newpath,oldbyte,oldpath,ptcpath,workspace(23552):BYTE
 00E4      DIM action,count,errnum,filesize,hexval,lineptr,loopcount,offset:INTEGER
 0107       DIM dblqt:STRING[1]
 0113       DIM inline:STRING[200]
 011F       (* set up double quote character for messages *)
 014F       dblqt:=CHR$($22)
 0158       (* initialize paths to impossible numbers *)
 0184       newpath:=$FF \oldpath:=$FF \ptcpath:=$FF
 019C       (* clear error flag *)
 01B2       errnum:=0
 01B9       ON ERROR GOTO 10000
 01BF       IF ptcfile="-?" THEN
 01CD         (* generate artificial error to print usage message *)
 0203         ERROR 1
 0207       ENDIF
 0209       IF ptcfile="/0" THEN
 0217         ptcpath:=0
 021E       ELSE
 0222         IF ptcfile="/1" THEN
 0230           ptcpath:=1
 0237         ELSE
 023B           IF ptcfile="/2" THEN
 0249             ptcpath:=2
 0250           ELSE
 0254             OPEN #ptcpath,ptcfile:READ
 0260           ENDIF
 0262         ENDIF
 0264       ENDIF
 0266       OPEN #oldpath,oldfile:READ
 0272       CREATE #newpath,newfile:UPDATE
 027E       ON ERROR GOTO 11000
 0284       (* set up I$Read syscall *)
 029F       callcode:=$89
 02A7       regs.a:=oldpath
 02B3       regs.x:=ADDR(workspace)
 02C1       regs.y:=SIZE(workspace)
 02CF       (* I$Read syscall is used for maximum speed *)
 02FD       RUN syscall(callcode,regs)
 030C       IF LAND(regs.cc,$01)<>0 THEN
 031F         ERROR regs.b
 0327       ENDIF
 0329       IF NOT(EOF(#oldpath)) THEN
 0334         PRINT #2,oldfile; " is too large."
 034E         PRINT #2,"FilePatch is limited to "; SIZE(workspace);
 0375         PRINT #2 USING "' ($',H4",SIZE(workspace);
 038C         PRINT #2,") byte files."
 03A1         ERROR 207
 03A5       ENDIF
 03A7       CLOSE #oldpath
 03AD       (* I$Read returns bytes read in Y register *)
 03DA       filesize:=regs.y
 03E5       (* initialize command action *)
 0404       action:=0
 040B       WHILE NOT(EOF(#ptcpath)) AND action<>2 DO
 041D         INPUT #ptcpath,"FilePatch:  Command line?  ",inline
 0445         (* echo patch input line to standard error output *)
 0479         PRINT #2,inline
 0482         (* null line is ignored *)
 049C         action:=(SUBSTR(LEFT$(inline,1),"**QqCcDdIiVv")+1)/2
 04BC         IF action>0 THEN
 04C8           (* set line pointer past command character *)
 04F5           lineptr:=2
 04FC           ON action GOSUB 1000,1000,1100,1200,1300,1400
 051B         ELSE
 051F           PRINT #2,"Unrecognized command."
 053C           errnum:=$C0
 0544         ENDIF
 0546       ENDWHILE
 054A       CLOSE #ptcpath
 0550       (* set up I$Write syscall *)
 056C       callcode:=$8A
 0574       regs.a:=newpath
 0580       regs.x:=ADDR(workspace)
 058E       regs.y:=filesize
 059A       (* I$Write syscall is used for maximum speed *)
 05C9       RUN syscall(callcode,regs)
 05D8       IF LAND(regs.cc,$01)<>0 THEN
 05EB         ERROR regs.b
 05F3       ENDIF
 05F5       CLOSE #newpath
 05FB       IF errnum<>0 THEN
 0607         ERROR errnum
```


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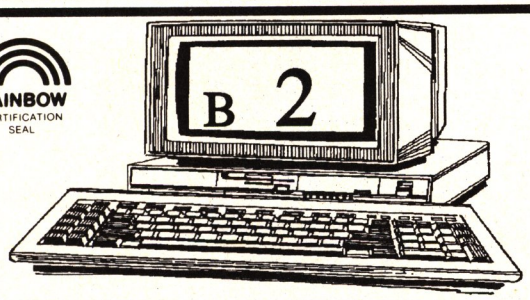
```
060C       ENDIF
060E       END
0610 1000
0614       (* ignore comment line *)
062D       (* do nothing if quit command *)
064D       RETURN
064F 1100
0653       (* change oldbyte at offset to newbyte *)
067C       GOSUB 3000
0680       offset:=hexval
0688       GOSUB 2000
068C       oldbyte:=hexval
0694       GOSUB 2000
0698       IF offset<filesize THEN
06A5         IF workspace(offset)=oldbyte THEN
06B5           workspace(offset)=hexval
06C1         ELSE
06C5           PRINT #2,"Expecting ";
06D8           PRINT #2 USING "H2,', found ',H2",oldbyte,workspace(offset);
06FC           PRINT #2,", can't change byte."
0718           errnum:=$C0
0720         ENDIF
0722       ELSE
0726         PRINT #2,"Offset too large, can't change byte."
0752         errnum:=$C0
075A       ENDIF
075C       RETURN
075E 1200
0762       (* delete count oldbytes starting at offset *)
0790       GOSUB 3000
0794       offset:=hexval
079C       GOSUB 3000
07A0       count:=hexval
07A8       IF count+offset<=filesize THEN
07B9         FOR loopcount=0 TO count-1
07CD           GOSUB 2000
07D1           IF workspace(offset+loopcount)<>hexval THEN
07E5             PRINT #2,"Expecting ";
07F8             PRINT #2 USING "H2,', found ',H2",hexval,workspace(offset+loopcount);
0820             PRINT #2,", can't delete byte(s)."
083F             errnum:=$C0
0847           ENDIF
0849         NEXT loopcount
0854         filesize:=filesize-count
0860         FOR loopcount=offset TO filesize-1
0875           workspace(loopcount):=workspace(loopcount+count)
0888         NEXT loopcount
0893       ELSE
0897         PRINT #2,"Offset and/or count too large, can't delete byte(s)."
08D3         errnum:=$C0
08DB       ENDIF
08DD       RETURN
08DF 1300
08E3       (* insert count newbytes starting at offset *)
0911       GOSUB 3000
0915       offset:=hexval
091D       GOSUB 3000
0921       count:=hexval
0929       IF offset<=filesize THEN
0936         IF count+filesize<=SIZE(workspace) THEN
0949           filesize:=filesize+count
0955           FOR loopcount=filesize-1 TO offset+count STEP -1
0974             workspace(loopcount):=workspace(loopcount-count)
0987           NEXT loopcount
0992         ELSE
0996           PRINT #2,"Count too large, can't insert byte(s)."
09C4           errnum:=$C0
09CC         ENDIF
09CE       ELSE
09D2         PRINT #2,"Offset too large, can't insert byte(s)."
0A01         errnum:=$C0
0A09       ENDIF
0A0B       FOR loopcount=offset TO offset+count-1
0A24         GOSUB 2000
0A28         workspace(loopcount):=hexval
0A34       NEXT loopcount
0A3F       RETURN
0A41 1400
0A45       (* validate module CRC *)
0A5E       IF workspace(0)=$87 AND workspace(1)=$CD THEN
0A77         IF workspace(2)=filesize/256 AND workspace(3)=MOD(filesize,256) THEN
0A98           (* update module header check byte *)
0ABD           workspace(8):=workspace(0)
0ACA           FOR loopcount=1 TO 7
0ADA             workspace(8):=LXOR(workspace(loopcount),workspace(8))
0AEE           NEXT loopcount
0AF9           workspace(8):=LNOT(workspace(8))
0B07           (* initialize CRC accumulator *)
0B27           FOR loopcount=0 TO 2
0B37             crc(loopcount):=$FF
0B43           NEXT loopcount
0B4E           (* set up F$CRC syscall *)
```

```
0B68            callcode:=$17
0B70            regs.x:=ADDR(workspace)
0B7E            regs.y:=filesize-3
0B8D            regs.u:=ADDR(crc)
0B9B            RUN syscall(callcode,regs)
0BAA            (* copy complemented CRC accumulator into module *)
0BDD            FOR loopcount=0 TO 2
0BED              workspace(filesize-3+loopcount):=LNOT(crc(loopcount))
0C04            NEXT loopcount
0C0F          ELSE
0C13            PRINT #2,"Module size doesn't match file size."
0C3F            errnum:=$C0
0C47          ENDIF
0C49        ELSE
0C4D          PRINT #2,"Not an OS-9/6809 module."
0C6D          errnum:=$C0
0C75        ENDIF
0C77        RETURN
0C79 2000
0C7D        (* skip leading spaces and get hex byte value *)
0CAD        GOSUB 3000
0CB1        IF hexval<0 OR hexval>255 THEN
0CC4          PRINT #2,"Invalid hexadecimal byte value."
0CEB          errnum:=$C0
0CF3        ENDIF
0CF5        RETURN
0CF7 3000
0CFB        (* skip leading spaces and get hex integer value *)
0D2E        WHILE lineptr<=LEN(inline) AND MID$(inline,lineptr,1)=" " DO
0D4A          lineptr:=lineptr+1
0D55        ENDWHILE
0D59        IF lineptr>LEN(inline) THEN
0D67          PRINT #2,"Invalid command line."
0D84          errnum:=$C0
0D8C        ENDIF
0D8E        hexval:=VAL("$"+MID$(inline,lineptr,LEN(inline)+1-lineptr))
0DAB        IF hexval<0 OR hexval>SIZE(workspace) THEN
0DC1          PRINT #2,"Invalid hexadecimal value."
0DE3          errnum:=$C0
0DEB        ENDIF
0DED        (* skip to next space or end of line *)
0E14        WHILE lineptr<=LEN(inline) AND MID$(inline,lineptr,1)<>" " DO
0E30          lineptr:=lineptr+1
0E3B        ENDWHILE
0E3F        RETURN
0E41 10000
0E45        ON ERROR GOTO 11000
```

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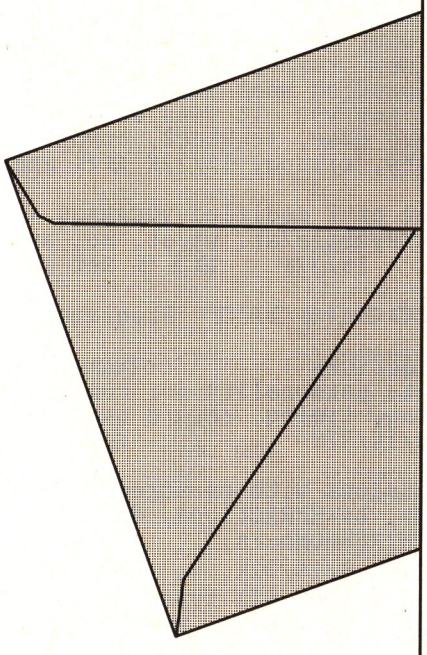

```
ØE4B      PRINT #2,"Usage:  FilePatch (“; dblqt; “<patchpath>”;
ØE79      PRINT #2,dblqt; “,”; dblqt; “<oldpath>”; dblqt; “,”; dblqt;
ØEA3      PRINT #2,”<newpath>”; dblqt; “)”
ØEBC      PRINT #2
ØEC1      PRINT #2,"Purpose:  To apply patch from <patchpath> to <oldpath>"
ØEFF      PRINT #2,"          and create <newpath>.  If <patchpath> is '/Ø',"
ØF3F      PRINT #2,"          '/1', or '/2', patch source is standard input,"
ØF7F      PRINT #2,"          output, or error output, respectively."
ØFB7      PRINT #2
ØFBC      PRINT #2,"Commands:  * comment"
ØFD8      PRINT #2,"             - Line beginning with asterisk is ignored."
1017      PRINT #2,"           C offset oldbyte newbyte"
1042      PRINT #2,"             - Change oldbyte at offset to newbyte."
107D      PRINT #2,"           D offset count oldbyte [oldbyte] [...]"
10B6      PRINT #2,"             - Delete count oldbytes starting at offset."
10F6      PRINT #2,"           I offset count newbyte [newbyte] [...]"
112F      PRINT #2,"             - Insert count newbytes starting at offset."
116F      PRINT #2,"           Q - Quit (REQUIRED to end interactive mode)."
11AE      PRINT #2,"           V - Validate (update) module CRC."
11E2      PRINT #2
11E7      PRINT #2,"Note:  Shell+ users may omit the parentheses and double"
1226      PRINT #2,"       quotes around the <pathlist> parameters."
125D 11000
1261      errnum:=ERR
1267      ON ERROR GOTO 11001
126D      IF ptcpath>2 THEN
1279        CLOSE #ptcpath
127F      ENDIF
1281 11001
1285      ON ERROR GOTO 11002
128B      CLOSE #oldpath
1291 11002
1295      ON ERROR GOTO 11003
129B      CLOSE #newpath
12A1 11003
12A5      ON ERROR GOTO 11004
12AB      IF errnum<>218 THEN
12B7        DELETE newfile
12BC      ENDIF
12BE 11004
12C2      ON ERROR
12C5      IF errnum<>1 THEN
12D1        PRINT #2,"FilePatch:  “;
12E6        ERROR errnum
12EB      ENDIF
12ED      END
```

Listing 3: clock5Ø.ptc

```
* FilePatch patch file to add
* GIME CART* toggle. For un-
* modified “Clock.50Hz” module
* file from CoCo 3 Level 2,
* Version Ø2.ØØ.Ø1 OS-9.
C ØØØ2 Ø1 Ø2
C ØØØ3 F7 13
C ØØØ8 ØE E9
C ØØØA A8 C4
C ØØ12 Ø9 ØA
C ØØ15 7E 9A
C ØØ18 ØØ 1C
C ØØ1B 41 5D
C ØØ34 Ø4 Ø6
C ØØ35 DC 3Ø
C ØØ36 26 8D
C ØØ58 C4 C2
C ØØ86 DC 9E
C ØØ88 DD 9F
C ØØBE Ø6 Ø4
C ØØBF AD 8D
C ØØC0 9F B3
C ØØC1 ØØ 2Ø
C ØØC2 26 Ø2
C ØØC3 24 8D
C ØØC4 FA B5
C Ø191 D6 C6
C Ø1C2 67 4B
C Ø1CE 44 28
I ØØ37 Ø2 ØØ 57
I ØØ9Ø Ø8 AD 9F ØØ 26 24 FA 86 FE
I ØØ98 Ø8 94 AF 97 AF 96 92 1F 89
I ØØA0 Ø8 84 FE B7 FF 92 F7 FF 92
I ØØA8 Ø2 5F 39
V
* The 3 CRC byte changes below
* are for comparison only.
*C Ø21Ø DD E8
*C Ø211 FD EØ
*C Ø212 68 19
```

Listing 4: clock6Ø.ptc

```
* FilePatch patch file to add
* GIME CART* toggle. For un-
* modified “Clock.60Hz” module
* file from CoCo 3 Level 2,
* Version Ø2.ØØ.Ø1 OS-9.
C ØØØ2 Ø1 Ø2
C ØØØ3 EE ØA
C ØØØ8 17 FØ
C ØØØA A8 C4
C ØØ12 Ø9 ØA
C ØØ15 7E 9A
C ØØ18 ØØ 1C
C ØØ1B 41 5D
C ØØ34 Ø4 Ø6
C ØØ35 DC 3Ø
C ØØ36 26 8D
C ØØ58 C4 C2
C ØØ86 DC 9E
C ØØ88 DD 9F
C ØØBE Ø6 Ø4
C ØØBF AD 8D
C ØØC0 9F B3
C ØØC1 ØØ 2Ø
C ØØC2 26 Ø2
C ØØC3 24 8D
C ØØC4 FA B5
C Ø191 D6 C6
C Ø1B9 7Ø 54
C Ø1C5 4D 31
I ØØ37 Ø2 ØØ 57
I ØØ9Ø Ø8 AD 9F ØØ 26 24 FA 86 FE
I ØØ98 Ø8 94 AF 97 AF 96 92 1F 89
I ØØA0 Ø8 84 FE B7 FF 92 F7 FF 92
I ØØA8 Ø2 5F 39
V
* The 3 CRC byte changes below
* are for comparison only.
*C Ø2Ø7 D2 Ø5
*C Ø2Ø8 8A 32
*C Ø2Ø9 FD 9E
```

Listing 5: init.ptc

```
* FilePatch patch file to fix
* IRQ/VIRQ table size. For un-
* modified “Init” module file
* from CoCo 3 Level 2 Version
* Ø2.ØØ.Ø1 OS-9.
C ØØØC ØF ØC
V
* The 3 CRC byte changes below
* are for comparison only.
*C ØØ2B ØB 68
*C ØØ2C 23 Ø4
*C ØØ2D 22 56
```

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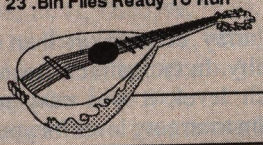

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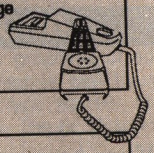

RAINBOW CERTIFICATION SEAL

GRAPHICS 1-14

GR1 - 12 Basic Graphic Programs
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GR6 - 22 Coco Max Pictures
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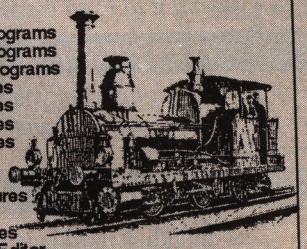

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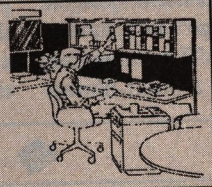

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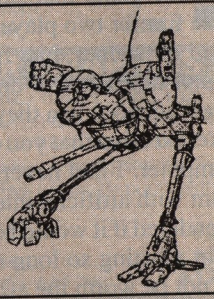

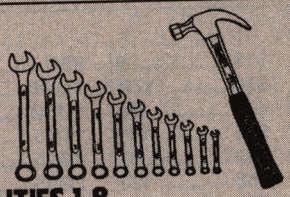

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M6	GR6	H1	U6	GA6
M7	GR7	H2	U7	GA7
	GR8	H3	U8	GA8
A1	GR9	H4		GA9
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T1	GR12			
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EZ-Thello Plays Back

by Fred B. Scerbo
Contributing Editor

If you have an idea for the "Wishing Well," submit it to Fred c/o THE RAINBOW. *Remember, keep your ideas specific, and don't forget this is* BASIC. *All programs resulting from your wishes are for your use, but remain the property of the author.*

Last month I introduced the first new game in months. *EZ-Thello* is a quick and easy version of a classic game that provides hours of fun for two players.

I had no sooner than finished the program and unleashed it on my more than willing students when they challenged me to make a version that you can play against the computer. I had never tried to write a program with artificial intelligence before and wondered if it would be too difficult or result in a listing so long and slow that it would not be worth the effort.

The project was not as difficult as I had imagined it would be. The initial intelligence subroutine took me about an hour and a half to design. But the first time I played it, I beat it easily. Something was still not right.

I made a quick check through the listing and noticed some bugs in my design. I corrected the problems after graphing out the possible options on a grid. The program was then bug-free, but the listing for the routine was almost 90 lines long.

Several of my students tried the program, and lo and behold, they could not beat it at first. Only after several days of playing could they occasionally beat it, then eventually on a regular basis.

That's when I decided to take the program several steps further. By switching from a long list of IF...THEN statements to a much shorter set of two variable statements fed off an array and a set of DATA statements, I was able to crunch the routine down to 10 lines — quite a feat in *any* programming situation.

The DATA statements (at the end of the listing) let me easily rearrange which squares the program checked first. The statements also let me, by the use of a multi-dimensional array, create more than one level of difficulty. In fact, after I created the most difficult level, it was easy to scale the program to an easy level for young players.

Some students quickly learned how to second guess the logic of the program. I solved this by adding a short random routine that rotates the gameboard in four directions when the computer is considering its logic and choices. This makes the program more interesting and much less predictable. Some students still cannot beat this final version at Level 6.

Even after I added all the extra information for the six levels, there are still only 32

Fred Scerbo is a special needs instructor for the North Adams Public Schools in North Adams, Massachusetts. He holds a master's in education and has published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.

32K Extended

20 108	315 9	950 117
50 236	375 170	1005 128
72 22	445 188	1060 19
100 176	515 139	1105 14
155 223	585 67	2025 154
185 47	655 177	2095 117
220 101	725 192	2175 247
250 168	800 226	2255 101
265 204	880 98	END 99

The Listing: EZTHELO2

```
1 REM****************************
2 REM*      E-Z-THELLO 2        *
3 REM*   COPYRIGHT (C)  1990   *
4 REM*          ADAPTED         *
5 REM*     BY FRED B. SCERBO    *
6 REM*     60 HARDING AVENUE    *
7 REM*  NORTH ADAMS, MA 01247   *
8 REM****************************
9 CLEAR500
10 CLS0:PRINTSTRING$(32,220);STR
ING$(32,204);
15 FORI=1TO160:READA:IFA<128THEN
25
20 CLS:PRINT@96," GO BACK AND CH
ECK YOUR DATA IN  LINES 30-50. I
 THINK YOU MADE   A TYPO !":PRIN
T:PRINT:END
25 PRINTCHR$(A+144);:NEXT
30 DATA31,31,31,26,31,31,31,31,,
47,47,47,47,42,47,42,37,47,37,47
,47,47,37,47,32,37,47,,37,47,47,
47
35 DATA31,26,16,,,,23,30,,,37,47
,32,,47,42,37,47,37,47,32,,37,47
,32,37,47,,37,42,32,47
40 DATA31,31,26,28,24,23,30,16,2
8,24,37,47,32,,47,47,47,47,37,47
,47,42,37,47,32,37,47,,37,42,,47
```

lines, which is better than the earlier 90 lines for only one level.

Typing in the Program

To make this program easy to type in, I included an error-trapping routine for the titlecard. I also arranged the listing so 75 percent of it is identical to last month's *EZ-Thello*. If you already have a bug-free version of that program saved, just type in lines 2, 60, 65, 70, 71, 72, 75, 76, 77, 78, 79, 86, 87, 255 and 301 from the new listing once you have loaded the old program. Also type in everything after Line 2000.

This changes the old program to the new one and saves countless hours of typing for those who don't get RAINBOW ON DISK or TAPE. The instructions at the beginning of the program are arranged to reflect that it is now a single-player game only.

Playing the Game

You may select up to six skill levels, Number 1 being the easiest. You play the white circles; the computer has the black circles. You must go first; if you want the computer to go first, press P for Pass.

Remember, you can only place a piece where it will trap one or more of your opponents between two or more of your color. The machine does the flipping for you. If you need more information on playing the game, check last month's column. This game is played exactly the same way, only this time you play the computer.

If the computer cannot make a legal move, it passes the move back to you. If you cannot make a legal move at any point, you must pass the turn back to the computer by pressing P.

If neither you nor the computer can make a legal move, press E to end the game. The computer keeps the game's score and declares the winner. It's that simple.

Conclusion

You'll find this single-player version interesting. A student has suggested a slightly different, three-dimensional version, as in 3-D chess or checkers. That may just be a challenge I take. See you next month. ❑

```
45 DATA31,26,,,21,31,16,,,,37,47
,32,,47,42,37,47,37,47,32,32,37,
47,32,37,47,,37,42,,47
50 DATA31,31,31,26,21,31,31,31,,
,37,47,32,,47,42,37,47,37,47,47,
47,37,47,47,37,47,47,37,47,47,47
55 PRINTSTRING$(32,195);STRING$(
32,211);
60 PRINT@326," AUTO-PLAY VERSION
  ";:PRINT@358,"      ADAPTED
    ";
65 PRINT@390,"  BY FRED B.SCERBO
  ";:PRINT@422," COPYRIGHT (C) 1
990 ";
70 PRINT@454," SELECT LEVEL (1-6
) ";
71 PRINT@353,CHR$(157)CHR$(156)C
HR$(158);:PRINT@385,CHR$(149)CHR
$(128)CHR$(154);:PRINT@417,CHR$(
151)CHR$(147)CHR$(155);
72 PRINT@380,CHR$(157)CHR$(156)C
HR$(158);:PRINT@412,CHR$(149)CHR
$(128)CHR$(154);:PRINT@444,CHR$(
151)CHR$(147)CHR$(155);
74 X$=INKEY$:IFX$=""THEN74
75 DL=VAL(X$):IF DL>6THEN74
76 IF DL<1THEN74
80 CLS:PRINT@231,"PLEASE STAND B
Y !";
85 DIM SQ(6,6),A(6),B(6),N$(9)
86 DIM C(32,6),D(32,6),NN(32),N(
4)
87 GOSUB2280:FORGG=1TO6:FORJJ=1T
O32:READ C(NN(JJ),GG),D(NN(JJ),G
G):NEXTJJ,GG
90 REM WH=1:BL=2
95 SQ(3,3)=1:SQ(4,4)=1:SQ(3,4)=2
:SQ(4,3)=2
100 N$(0)="U12R8D12NL8BR6":N$(1)
="BR3R3U12NG3D12R3BR5":N$(2)="NR
8U6R8U6NL8BD12BR6":N$(3)="R8U6NL
8U6NL8D12BR6":N$(4)="BU6NU6R8U6D
12BR6":N$(5)="R8U6L8U6R8BD12BR6"
105 N$(6)="R8U6L8D6U12R6BD12BR6"
:N$(7)="BR8U12L8ND2R8D12BR6":N$(
8)="NU12R8U6NL8U6NL8D12BR6":N$(9
)="BR8U12L8D6R8D6BR6"
110 PMODE4,1:PCLS1:SCREEN0,0
115 LINE(0,0)-(196,160),PRESET,B
120 LINE(1,1)-(195,159),PRESET,B
125 FORI=2TO194STEP32
130 LINE(I,2)-(I,158),PRESET:NEX
T
135 FORI=2TO158STEP26:LINE(2,I)-
(194,I),PRESET:NEXT
140 B=1
145 FORY=15TO145STEP26
150 B(B)=Y:B=B+1:NEXT
155 A=1
160 FORI=18TO178STEP32
```


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```
165 A(A)=I:A=A+1:NEXT
170 DRAW"BM0,190C0U26R20D6L12D4R
12D6L12D4R12D6NL20BU10BR6R12U6L1
2D6BD10BR16U6E14L14U6R24D6G14R14
D6NL24BU10BR6R12U6L12D6BU16BR16R
28D6L10D20L8U20L10U6BR34"
175 DRAW"D26R8U10R10D10R8U26L8D1
0L10U10L8BR32BD26U26R20D6L12D4R1
2D6L12D4R12D6NL20BR6U26R8D20R10D
6NL18BR6U26R8D20R10D6NL18BR6U26R
24D26L24BE6BR2R8U14L8D14"
180 PAINT(4,188),0,0:PAINT(28,17
8),0,0:PAINT(44,188),0,0
185 COLOR1,0:FORI=2TO72STEP4:LIN
E(I,190)-(I,162),PSET:NEXT
190 PAINT(82,178),0,0:PAINT(100,
178),0,0:PAINT(130,178),0,0:PAIN
T(160,178),0,0:PAINT(184,178),0,
0
195 PAINT(206,178),0,0:PAINT(248
,178),0,0
200 CIRCLE(82,67),12,0,.9:CIRCLE
(82,93),12,0,.9
205 CIRCLE(114,67),12,0,.9:CIRCL
E(114,93),12,0,.9
210 LINE(200,0)-(256,58),PRESET,
B
215 LINE(201,1)-(254,57),PRESET,
B
220 DRAW"BM204,4C0D4F4ND4E4U4BR4
D12R8U12NL8BR4D12R8U12BR4ND12R8D
6L8R2F6"
225 DRAW"BM204,42R4ND12R4BR4D12R
8U12BR4ND12R8D6L8R2F6BR4U12M+8,+
12U12"
230 LINE(200,62)-(256,160),PRESE
T,B:LINE(201,63)-(254,159),PRESE
T,B
235 CIRCLE(226,78),12,0,.9:CIRCL
E(226,124),12,0,.9:PAINT(226,124
),0,0
240 PAINT(80,91),0,0:PAINT(112,6
5),0,0
245 BD$="C0BU12L15D24R30U24L15BD
12"
250 BU$="C1BU12L15D24R30U24L15BD
12"
255 CLS:PRINT@32," E-Z-THELLO IS
 A SIMPLIFIED &    QUICK PLAYING
 VERSION OF THE    CLASSIC STRAT
EGY GAME. ONLY     ONE PLAYER IS
 NEEDED. YOU ARE   WHITE AND THE
 COMPUTER IS THE   BLACK. YOU MU
ST PLACE A PIECE"
260 PRINT" SO IT TRAPS YOUR OPPO
NENT'S     PIECES BETWEEN YOURS.
 THEY WILL THEN SWITCH TO YOUR C
OLOR. IF   YOU CANNOT MAKE A LEG
AL MOVE    PRESS <P> TO PASS ON
THAT TURN.";
265 PRINT" IF NO ONE CAN MAKE A
LEGAL MOVE THEN PRESS <E> TO END
 THE GAME. PRESS <ENTER> TO PLAY
.";
270 X$=INKEY$:IFX$<>CHR$(13)THEN
270
275 CLS0:X=1:Y=1
280 SW=1:CC=2:GOTO290
285 SW=2:CC=1
290 TT=0:CIRCLE(226,29),12,0,.9:
PAINT(226,29),SW,SW:CIRCLE(226,2
9),12,0,.9:GOSUB1010
295 IF BL+WH=36THEN1080
300 C$="BM"+STR$(A(X))+","+STR$(
B(Y))
301 D$=C$
305 DRAW C$:DRAW BD$
306 IF SW=2THEN2000
310 A$=INKEY$:SCREEN1,0
315 DRAW BU$:DRAW BD$:DRAW BU$
320 IFA$="P"THEN1000
325 IFA$="E"THEN1080
330 IFA$=""THEN310ELSET=ASC(A$)
335 IFT=8THENX=X-1:IFX<1THENX=1:
GOTO360
340 IFT=9THENX=X+1:IFX>6THENX=6:
GOTO360
345 IFT=94THENY=Y-1:IFY<1THENY=1
:GOTO360
350 IFT=10THENY=Y+1:IFY>6THENY=6
:GOTO360
355 IFT=13THEN365
360 GOTO300
365 IF SQ(X,Y)=0THEN370 ELSE300
370 EX=0
375 IFY=1THEN440
380 FORQ=Y-1TO1STEP-1
385 IFSQ(X,Q)=0THEN405
390 IFSQ(X,Q)=SW THEN410
395 IFSQ(X,Q)=CC THEN EX=1
400 NEXT
405 IF EX=1THEN440
410 IF EX=0THEN440
415 FORK=Y TO Q STEP-1
420 CIRCLE(A(X),B(K)),12,0,.9:PA
INT(A(X),B(K)),SW,SW:CIRCLE(A(X)
,B(K)),12,0,.9
425 TT=1
430 SQ(X,K)=SW
435 NEXT
440 EX=0
445 IFY=6THEN510
450 FORQ=Y+1TO6
455 IFSQ(X,Q)=0THEN475
460 IFSQ(X,Q)=SW THEN480
465 IFSQ(X,Q)=CC THEN EX=1
470 NEXT
475 IF EX=1THEN510
480 IF EX=0THEN510
485 FORK=Y TO Q
490 CIRCLE(A(X),B(K)),12,0,.9:PA
INT(A(X),B(K)),SW,SW:CIRCLE(A(X)
,B(K)),12,0,.9
495 TT=1
500 SQ(X,K)=SW
505 NEXT
510 EX=0
515 IFX=6THEN580
520 FORQ=X+1TO6
525 IFSQ(Q,Y)=0THEN545
530 IFSQ(Q,Y)=SW THEN550
535 IFSQ(Q,Y)=CC THEN EX=1
540 NEXT
545 IF EX=1THEN580
550 IF EX=0THEN580
555 FORK=X TO Q
560 CIRCLE(A(K),B(Y)),12,0,.9:PA
INT(A(K),B(Y)),SW,SW:CIRCLE(A(K)
,B(Y)),12,0,.9
565 TT=1
570 SQ(K,Y)=SW
575 NEXT
580 EX=0
585 IFX=1THEN650
590 FORQ=X-1TO1STEP-1
595 IFSQ(Q,Y)=0THEN615
600 IFSQ(Q,Y)=SW THEN620
605 IFSQ(Q,Y)=CC THEN EX=1
610 NEXT
615 IF EX=1THEN650
620 IF EX=0THEN650
625 FORK=X TO Q STEP-1
630 CIRCLE(A(K),B(Y)),12,0,.9:PA
INT(A(K),B(Y)),SW,SW:CIRCLE(A(K)
,B(Y)),12,0,.9
635 TT=1
640 SQ(K,Y)=SW
645 NEXT
650 PP=0:EX=0
655 IFY=1THEN735
660 FORQ=Y-1TO1STEP-1
665 PP=PP+1:IF X+PP>6THEN735
670 IFSQ(X+PP,Q)=0THEN690
675 IFSQ(X+PP,Q)=SW THEN695
680 IFSQ(X+PP,Q)=CC THEN EX=1
685 NEXT
690 IF EX=1THEN735
695 IF EX=0THEN735
700 PP=-1
705 FORK=Y TO Q STEP-1
710 PP=PP+1
715 CIRCLE(A(X+PP),B(K)),12,0,.9
:PAINT(A(X+PP),B(K)),SW,SW:CIRCL
E(A(X+PP),B(K)),12,0,.9
720 TT=1
725 SQ(X+PP,K)=SW
730 NEXT
735 PP=0:EX=0
740 IFY=1THEN820
745 FORQ=Y-1TO1STEP-1
750 PP=PP-1:IF X+PP<1THEN820
755 IFSQ(X+PP,Q)=0THEN775
760 IFSQ(X+PP,Q)=SW THEN780
765 IFSQ(X+PP,Q)=CC THEN EX=1
770 NEXT
775 IF EX=1THEN820
780 IF EX=0THEN820
785 PP=1
790 FORK=Y TO Q STEP-1
795 PP=PP-1
800 CIRCLE(A(X+PP),B(K)),12,0,.9
:PAINT(A(X+PP),B(K)),SW,SW:CIRCL
E(A(X+PP),B(K)),12,0,.9
805 TT=1
810 SQ(X+PP,K)=SW
815 NEXT
820 PP=0:EX=0
825 IFY=6THEN905
830 FORQ=Y+1TO6
835 PP=PP+1:IF X+PP>6THEN905
840 IFSQ(X+PP,Q)=0THEN860
845 IFSQ(X+PP,Q)=SW THEN865
850 IFSQ(X+PP,Q)=CC THEN EX=1
855 NEXT
860 IF EX=1THEN905
865 IF EX=0THEN905
870 PP=-1
875 FORK=Y TO Q
880 PP=PP+1
885 CIRCLE(A(X+PP),B(K)),12,0,.9
:PAINT(A(X+PP),B(K)),SW,SW:CIRCL
E(A(X+PP),B(K)),12,0,.9
890 TT=1
```

```
895 SQ(X+PP,K)=SW
900 NEXT
905 PP=0:EX=0
910 IFY=6THEN990
915 FORQ=Y+1TO6
920 PP=PP-1:IF X+PP<1THEN990
925 IFSQ(X+PP,Q)=0THEN945
930 IFSQ(X+PP,Q)=SW THEN950
935 IFSQ(X+PP,Q)=CC THEN EX=1
940 NEXT
945 IF EX=1THEN990
950 IF EX=0THEN990
955 PP=1
960 FORK=Y TO Q
965 PP=PP-1
970 CIRCLE(A(X+PP),B(K)),12,0,.9
:PAINT(A(X+PP),B(K)),SW,SW:CIRCL
E(A(X+PP),B(K)),12,0,.9
975 TT=1
980 SQ(X+PP,K)=SW
985 NEXT
990 REM END OF ROUTINE
995 IFTT=0 AND SW=1THEN300
996 DRAW D$:DRAWBU$
997 IF SW=2THENRETURN
1000 IFSW=1THEN285ELSEIFSW=2THEN
280
1005 GOTO1005
1010 REM SCORE ROUTINE
1015 BL=0:WH=0:FORQ=1TO6:FORK=1T
O6
1020 IFSQ(Q,K)=1THEN WH=WH+1
1025 IFSQ(Q,K)=2THEN BL=BL+1
1030 NEXTK,Q
1035 LINE(206,92)-(248,110),PRES
ET,BF
1040 DRAW"BM216,107C1"
1045 Q$=STR$(WH):IF WH>9THEN Q$=
RIGHT$(Q$,2)
1050 FOR Q=1TO2:P$=MID$(Q$,Q,1):
P=VAL(P$):DRAW N$(P):NEXTQ
1055 LINE(206,138)-(248,156),PRE
SET,BF
1060 DRAW"BM216,153C1"
1065 Q$=STR$(BL):IF BL>9THEN Q$=
RIGHT$(Q$,2)
1070 FOR Q=1TO2:P$=MID$(Q$,Q,1):
P=VAL(P$):DRAW N$(P):NEXTQ
1075 RETURN
1080 LINE(200,0)-(256,58),PRESET
,BF
1085 IF BL>WH THEN CIRCLE(226,20
),12,1,.9
1090 IF WH>BL THEN CIRCLE(226,20
),12,1,.9:PAINT(226,20),1,1
1095 IF WH=BL THEN 1110
1100 DRAW"BM206,40C1D12R6NU12R6N
U12BR6NU12BR6U12M+8,+12NU12BR4R6
U6L6U6R6"
1105 GOTO1115
1110 DRAW"BM209,24C1R6ND12R6BR6N
D12BR8NR8D6NR8D6R8"
1115 LINE(203,3)-(251,55),PSET,B
1120 X$=INKEY$:IFX$=CHR$(13)THEN
RUNELSE1120
2000 COLOR1,0:LINE(202,2)-(253,1
6),PSET,BF:FOR FF=1TO32
2005 DRAW"BM214,4C0ND12F6E6ND12B
R6D4F4ND4E4U4"
2010 IFSQ(C(FF,DL),D(FF,DL))=0TH
EN X=C(FF,DL):Y=D(FF,DL):GOSUB37
0
2015 IFTT=1THEN2025
2020 NEXTFF
2025 COLOR1,0:LINE(202,2)-(253,1
6),PSET,BF
2030 DRAW"BM204,4C0D4F4ND4E4U4BR
4D12R8U12NL8BR4D12R8U12BR4ND12R8
D6L8R2F6"
2035 GOTO1000
2040 DATA 2,1,1,2,6,5,5,6
2045 DATA 1,5,2,6,5,1,6,2
2050 DATA 2,2,5,5,5,2,2,5
2055 DATA 1,1,6,1,1,6,6,6
2060 DATA 3,5,4,5,3,2,4,2
2065 DATA 2,3,2,4,5,3,5,4
2070 DATA 3,1,4,1,1,3,1,4
2075 DATA 3,6,4,6,6,3,6,4
2080 DATA 2,1,1,2,6,5,5,6
2085 DATA 2,2,5,5,5,2,2,5
2090 DATA 1,5,2,6,5,1,6,2
2095 DATA 3,5,4,5,3,2,4,2
2100 DATA 1,1,6,1,1,6,6,6
2105 DATA 3,1,4,1,1,3,1,4
2110 DATA 2,3,2,4,5,3,5,4
2115 DATA 3,6,4,6,6,3,6,4
2120 DATA 1,1,6,1,1,6,6,6
2125 DATA 3,5,4,5,3,2,4,2
2130 DATA 2,3,2,4,5,3,5,4
2135 DATA 3,1,4,1,1,3,1,4
2140 DATA 3,6,4,6,6,3,6,4
2145 DATA 2,1,1,2,6,5,5,6
2150 DATA 1,5,2,6,5,1,6,2
2155 DATA 2,2,5,5,5,2,2,5
2160 DATA 1,1,6,1,1,6,6,6
2165 DATA 2,3,2,4,5,3,5,4
2170 DATA 3,5,4,5,3,2,4,2
2175 DATA 3,6,4,6,6,3,6,4
2180 DATA 3,1,4,1,1,3,1,4
2185 DATA 1,5,2,6,5,1,6,2
2190 DATA 2,1,1,2,6,5,5,6
2195 DATA 2,2,5,5,5,2,2,5
2200 DATA 1,1,6,1,1,6,6,6
2205 DATA 3,1,4,1,1,3,1,4
2210 DATA 3,6,4,6,6,3,6,4
2215 DATA 3,5,4,5,3,2,4,2
2220 DATA 2,3,2,4,5,3,5,4
2225 DATA 2,1,1,2,6,5,5,6
2230 DATA 1,5,2,6,5,1,6,2
2235 DATA 2,2,5,5,5,2,2,5
2240 DATA 1,1,6,1,1,6,6,6
2245 DATA 3,6,4,6,6,3,6,4
2250 DATA 3,1,4,1,1,3,1,4
2255 DATA 2,3,2,4,5,3,5,4
2260 DATA 3,5,4,5,3,2,4,2
2265 DATA 1,5,2,6,5,1,6,2
2270 DATA 2,1,1,2,6,5,5,6
2275 DATA 2,2,5,5,5,2,2,5
2280 FORII=0TO31STEP4
2285 N(1)=0:N(2)=0:N(3)=0:N(4)=0
2290 FORYY=1TO4
2295 P=RND(4):IF N(P)=1THEN2295
2300 N(P)=1:P(YY)=P:NEXTYY
2305 FORYY=1TO4
2310 NN(II+YY)=P(YY)+II
2315 NEXTYY
2320 NEXTII
2325 RETURN
```


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Now you, too, can have uncomplicated, readable listings

Frustration Extinguisher

by James Barnes

Have you ever had trouble finding that missing comma or quotation mark in a line number with a long series of commands? I have many times, so to lessen my frustration I wrote *Lister*.

Lister installs a hook into Color BASIC's LIST routine in ROM. Whenever a LIST or LLIST is entered, *Lister* checks the listing for a colon (:) or the BASIC word ELSE. If one or the other is located, the program sends a carriage return to CoCo's I/O device (in this case the monitor or the printer). It then sends a number of space characters to the I/O device to move the listing away from the line number. The result is a neat, uncomplicated and very readable listing — perfect for debugging.

Loading the Program

Listing 1 is the *EDTASM+* assembly language source code listing. Type the listing into your assembler exactly as it appears. You can omit the comments if you like. After assembly is error-free, load *Lister* from BASIC by typing the following (then press ENTER):

```
CLEAR10,&H7F90:(C)LOADM"LISTER":EXEC
```

When the OK prompt returns to the screen, *Lister* is installed and running.

Listing 2 is the BASIC installation program. If you don't have *EDTASM+*, type in the listing exactly as it appears. After you have saved it to disk or tape, RUN the program. When the Installed message appears onscreen, *Lister* can be saved to disk or tape by typing:

```
(C)SAVEM"LISTER",&H7F90,&H7FFE,&H7F90
```

To load the saved machine-language code, use the line shown for the assembly version above.

Lister was designed and written for the CoCo 3 and is written in position-independent code so it can be loaded anywhere in RAM and still function properly. In addition, *Lister* works on the CoCo 1 or 2, but your machine must be in the all-RAM mode before execution. You can find a listing of the all-RAM program on Page 109 of the April, 1990 issue of THE RAINBOW. ❑

James Barnes is a technical service technician for Baker Oil Tools. He is a self-taught programmer who never spends enough time with his CoCo. He may be contacted at 111-404-6 Ave., N.W., Slave Lake, Alberta T0G 2A1, Canada.

Listing 1: LISTER

```
00010 *         LISTER
00020 *  COPYRIGHT (C) 1990
00030 *           BY
00040 *    JAMES D. BARNES
00050
00070           ORG     $7F90   START ASSEMBLY AT $7F90
00080 START     LDA     #$7E    OPCODE FOR JMP
00090           STA     $B7BD   PLACE JMP IN ROM
00100           LEAX  BEGIN,PCR GET START ADDRESS OF LISTER
00110           STX     $B7BE   PUT IT IN ROM AS A HOOK
00120           RTS             RETURN TO BASIC
00130
00140 BEGIN     CMPA    #$3A    CHECK FOR COLON
00150           BEQ     STEP    GO IF COLON
00160           CMPA    #$45    CHECK FOR LETTER [E]
00170           BEQ     STEP2   GO IF IT'S THE LETTER [E]
00180
00190 PRINT     JSR     $B9B1   NOT FOR OUR HOOK-OUTPUT CHAR.
00200           JMP     $B7B9   GET THE NEXT CHARACTER
00210
00220 SPACE     LDA     #$0D    VALUE FOR [ENTER] KEY
00230           JSR     $B9B1   OUTPUT [ENTER] KEY
00240           LDB     #4      SET COUNTER FOR 4 SPACES
00250 LOOP      LDA     #$20    VALUE FOR [SPACE BAR]
00260           JSR     $B9B1   OUTPUT [SPACE BAR]
00270           DECB            DECREASE COUNTER
00280           BNE     LOOP    GO IF NOT DONE 4 [SPACE BAR]'S
00290           RTS             RETURN FROM SUBROUTINE
00300
00310 STEP      BSR     SPACE   GO MODIFY THE LISTING
00320           LDA     #$3A    VALUE FOR COLON
00330           BRA     PRINT   OUTPUT COLON & GET NEXT CHAR.
00340
00350 STEP2     STA     $CB     SAVE THE LETTER [E]
00360           LDA     ,U+     GET THE NEXT CHARACTER
00370           CMPA    #$4C    CHECK FOR LETTER [L]
00380           BNE     STEP3   GO IF NOT LETTER [L]
00390           STA     $00CC   SAVE LETTER [L]
00400           LDA     ,U+     GET NEXT CHARACTER
00410           CMPA    #$53    CHECK FOR LETTER [S]
00420           BNE     STEP4   GO IF NOT LETTER [S]
00430           STA     $CD     SAVE LETTER [S]
00440           BSR     SPACE   MUST BE WORD ELSE-GO DO IT.
00450           LDA     #$20    VALUE FOR [SPACE BAR]
00460           JSR     $B9B1   OUTPUT SPACE TO LINE UP LISTING
00470           BSR     ELSE    OUTPUT LETTERS [E] & [L]
00480           LDA     $CD     GET SAVED LETTER [S]
00490           BRA     PRINT   OUTPUT [S] & GET NEXT CHARACTER
00500
00510 STEP3     STA     $00CC   SAVE CHARACTER
00520           LDA     $CB     GET SAVED LETTER [E]
00530           JSR     $B9B1   OUTPUT LETTER [E]
00540           LDA     $00CC   GET SAVED CHARACTER
00550           BRA     PRINT   OUTPUT IT & GET NEXT CHARACTER
00560
00570 STEP4     STA     $CD     SAVE CHARACTER
00580           BSR     ELSE    OUTPUT LETTERS  [E] & [L]
00590           LDA     $CD     GET SAVED CHARACTER
00600           BRA     PRINT   OUTPUT IT & GET NEXT CHARACTER
00610
00620 ELSE      LDA     $CB     GET SAVED LETTER [E]
00630           JSR     $B9B1   OUTPUT LETTER [E]
00640           LDA     $00CC   GET SAVED LETTER [L]
00650           JSR     $B9B1   OUTPUT LETTER [L]
00660           RTS             RETURN FROM SUBROUTINE
00670
00680           END     START   START EXECUTION AT START
```

Listing 2: LISTER1

```
0 ' COPYRIGHT 1990 FALSOFT, INC
5 'LISTER
6 'COPYRIGHT (C) 1990 BY
7 'JAMES D. BARNES
10 CLEAR10,&H7F90
20 B=&H7F90
30 FOR A=1 TO 110
40 READ A$
50 C=VAL("&H"+A$)
60 POKEB,C:D=D+C
70 B=B+1
80 NEXT A
90 IF D<>14978 THEN CLS:PRINT"<D
ATA ERROR>-PLEASE CHECK DATA":E
ND
100 EXEC&H7F90
110 CLS:PRINT"LISTER HAS BEEN IN
STALLED"
120 DATA 86,7E,B7,B7,BD,30,8D,00
,04,BF,B7,BE,39
130 DATA 81,3A,27,1A,81,45,27,1C
,BD,B9,B1,7E,B7,B9
140 DATA 86,0D,BD,B9,B1,C6,04,86
,20,BD,B9,B1,5A,26,F8,39
150 DATA 8D,EE,86,3A,20,E4,97,CB
,A6,C0,81,4C,26,17,97,CC,A6,C0
160 DATA 81,53,26,1A,97,CD,8D,D6
,86,20,BD,B9,B1,8D,17,96,CD
170 DATA 20,C5,97,CC,96,CB,BD,B9
,B1,96,CC,20,BA
180 DATA 97,CD,8D,04,96,CD,20,B2
,96,CB,BD,B9,B1,96,CC,BD,B9,B1,3
9
```

CoCo 3 Does Windows

by Dale L.Puckett
Contributing Editor

Most CoCo 3 owners, especially those with OS-9 Level II, know their favorite computer does windows. Many, however, don't know what to do with them; others know what they want to do but have no idea where to start. We'll tackle these issues head on this month.

You can increase productivity by using the windows in OS-9 Level II. Even when you don't need to get a lot of work done, you'll find that working with windows is fun, and you can use them to impress your friends. Once you use OS-9 windows, you'll wonder how you ever got along without them.

Suppose you're using a word processor to edit a document. It's almost a form letter but not quite; eight of nine paragraphs are close, but not identical. Because most OS-9 programs are reentrant, they let you run one copy of a program in several windows simultaneously. To make your writing job easy, you need only open two 80-by-24 windows. In the first window start a shell and run your word processor to open and display the original document. In the second window start another shell, run your word processor and create a new document. As you type your revised letter in this second window, refresh your memory by pressing CLEAR to switch to the first iteration of your word processor displaying the model document. When you're ready to continue typing, press CLEAR again and you'll be typing in your new document.

Still not sold? Here's another example. If you're a new convert to OS-9 and are spoiled by the WYSIWYG word processors running under RS-DOS, you probably can't stand the OS-9 line editor, `edit`, or the line editor built into BASIC09. Yet you bought OS-9 because you heard it was a fantastic environment for developing programs, and this is your next major cause. What to do? You can solve your dilemma by creating two 80-by-24 text windows with a shell running in both. This time, however, you start BASIC09 running in one window and your favorite OS-9-based word processor in the other. Use the `chd` command in both windows to point the current data directory used by both programs to the same OS-9 directory.

Now press CLEAR to move to the window running the word processor and type the source code for your program. Remember to type the following as the very first line:

```
PROCEDURE nameofprogram
```

When you're ready to test your program, save your source code but leave the word processor running. Now press CLEAR to move to the window running BASIC09. Load your program into BASIC09 and test it. When you're ready to adjust the code or fix a bug, save the source code and press CLEAR to move back to the word processor window. Now open the source code and make your changes. Repeat this cycle until your program is running the way you want.

Getting Started with Windows

When you run OS-9 Level II out of the package, it starts up in a green 32-column VDG screen with black letters. To use the windows available in the system you must enter a few commands first. Start by playing around with the eight window descriptors built into OS-9 Level II.

If you run the `mdir` command, you'll see there is one window device descriptor named `w` and seven more named `w1` through `w7`. Each of these windows are predefined by the authors of the OS-9 system software. To avoid the typing needed to exercise these windows, order a copy of the disk that contains all the listings from *The Complete Rainbow Guide to OS-9 Level II, Volume 1: A Beginners Guide to Windows.*

Device window `/w7` is the most useful window out of the box because it gives you an 80-by-24 text screen that you can use immediately with most application packages. The others are useful to demonstrate additional window shapes, sizes and colors. Unfortunately most OS-9 application software still — three and a half years after the release of Level II — only runs in full-sized, 80-by-24 screens. In fact most of them have never been updated to take particular advantage of the Level II windowing system. This doesn't mean you can't use this functionality in your own programs; many persons are doing just that.

Each of the window descriptors, like any other device descriptor in an OS-9 system, must be initialized before it can be used. Do this by typing `iniz /w1`. Now the window is ready for use; it does not appear, however, until you display data in it and move to it with the CLEAR key. Type `date t >/w1`, then press CLEAR and you should see the date and time displayed when the screen containing window `/w1` appears. To initialize all seven window descriptors with one command, enter the following line:

```
iniz w1 w2 w3 w4 w5 w6 w7
```

Again, these windows do not appear until you display something in them. To display different things in different windows, use the redirection operators built

---

Dale L. Puckett, a freelance writer and programmer, serves as director-at-large of the OS-9 Users Group and is a member of the Computer Press Association. His username on Delphi is DALEP: on packet-radio, KOHYD @ N4QQ; on GEnie, D.PUCKETT2; and on CIS, 71446,736.

into `shell`. Use CLEAR to move to the green VDG screen and enter:

```
date t >/w1
dir /w3
echo Hello >/w4
shell i=/w7&
basic09 <>>>/w5&
```

The first three lines use the corresponding window to display their output. If you use the CLEAR key to move to window `/w1`, you see a date and time messages. In window `/w3` there is a listing of the current data directory used by shell running in the green `/term` window. The word "Hello" is printed in the upper-left corner of window `/w4`. The last two lines behave differently. In window `/w7` there is the familiar OS9: prompt. In window `/w5`, there is the BASIC09 banner and the language's B: prompt.

The fourth line above starts a shell running in window `/w7`. The `i=w7` indicates that the shell created is *immortal* — it does not go away when the current process terminates. Notice also the ampersand (&) at the end of the line. This tells OS-9 to run the new shell concurrently — in the background — while it continues to run the original shell that executed the command line. The new shell can be active and run its own processes — a fancy OS-9 word that indicates a running program — at the same time you are running other processes in another OS-9 window.

You can study the difference between an immortal shell and a normal shell by comparing the way each reacts to your attempt to terminate it. Create two different shells with the following commands:

```
shell i=/w1&
shell <>>>/w4&
```

Now use the CLEAR key to move to window `/w1`. Attempt to terminate the shell in that window by holding down CTRL while you press ESC. This sends an EOF (End-Of-File) signal to the shell, which tells it to terminate. In this case, however, when the shell terminates, it starts right back up again in the same window. To kill this *immortal* shell, use the `ex` command.

After you've tried to terminate the shell running in window `/w1` several times, move over to window `/w4`. Hold down CTRL and press ESC to terminate this shell. Like magic, the shell ends and the window it was running in disappears from your screen. To prove it's gone, use CLEAR to move back to the green `/term` window and run the OS-9 `procs` command. The process number of the copy of `shell` that was running in window `/w4` should be missing from the list of current processes.

In the experiment just described, we used windows `/w1` and `/w4` first, because if you try to create or use windows `/w2` or `/w3` before you create `/w1`, you generate an error. This happens because windows `/w2` and `/w3` are predefined to be on the same physical screen as window `/w1`. The same

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Type	Colors	Size	Memory Used
01	8	40-by-24 characters	2K
02	8	80-by-24 characters	4K
05	2	640-by-192 pixels	16K
06	4	320-by-192 pixels	16K
07	4	640-by-192 pixels	32K
08	16	320-by-192 pixels	32K

Table 1. Window Types

relationship holds true for windows /w4, /w5 and /w6. This assumes, however, you do not redefine them as described below.

The last of the five command lines above *forks* — or starts a new process — running concurrently in window /w5. This time the process running is BASIC09. When you terminate BASIC09 by holding down CTRL and pressing ESC or by issuing the BYE command, window /w5 disappears from your screen. To keep it around when you quit BASIC09, start an immortal shell in it, move to it and then start BASIC09 from within the window.

Customizing Windows on the Fly

After you've experimented with OS-9 Level II's built-in window descriptors, you'll most likely agree that most of them have rather limited application. You need a way to change them on the fly. It would also be handy to not need to worry about the particular window device name you are using when you create a new window, which was made possible by the OS-9 authors when they defined window descriptor /w. If you display anything on device /w, it appears on the next available window device. If you have already used windows /w1, /w2 and /w3 and redirect the output of an OS-9 command to device /w, it appears in window /w4 automatically.

As you begin to create and change windows, be aware that only one OS-9 device window can appear at the same spot on any screen. Unfortunately OS-9 device windows still cannot overlap each other. This means you are responsible for creating device windows with coordinates that do not cause your new window to overlay a window already existing on the same screen.

You can get around this problem by using OS-9 Level II's handy overlay windows. Any number of overlay windows may be stacked over each other, but there must be a valid device window at the *bottom* of the stack.

A second gotcha with overlay windows involves the type of device windows you created at the bottom of the stack. If you open a screen with a large text type device window, you will not be able to open a graphics overlay window on top of it and draw an icon for the person running your program.

You will find overlay windows are very handy when you need to send a message to the person running your program. In modern programs, overlay windows used in this manner are often called *dialog boxes*.

A review of the window types available to you is in Table 1. The predefined colors available within OS-9 Level II windows are in Table 2.

Before you set fingers to the keyboard and start creating windows, you must prepare yourself by determining the answer to a set of basic questions. To generate a complete windowing command line you must know the type of screen, the horizontal and vertical coordinate of your window's upper-left corner, the window's width and height, and the colors used for the text, background and border.

To make an 80-by-10 text device window appear at the top of your screen and display blue letters on a white background with a black border, use the codes 2, 0, 0, 80, 10, 1, 0, 2.

To create this window, use the OS-9 wcreate command or the display command. With the wcreate command you type the numbers above in decimal notation. With the display command, you must use hexadecimal. The commands look like this:

```
wcreate /w -s=2 0 0 80 10 1 0 2
```

or

```
display 1b 20 2 0 0 50 A 1 0 2 41 42
43 >/w1
```

You can use wcreate to create your window in the next available window descriptor, /w, but with the display command sequence you must send the characters to an existing screen not already in use. The 41, 42 and 43 at the end of the second command line above display the letters ABC at the top of the new window so you can identify it when you use the CLEAR key to move to it. They are not needed to create the window.

The two command lines in the example above show you how to create a new window. But how do you change an existing window rather than create a new one? Perhaps you have started a shell in the window descriptor /w1, but you would rather be running in a full 80-by-24 four-color graphics window. Use the OS-9 build command or edit to create the following procedure file. Name the file makegw.

```
display 1b 24
display 1b 20 7 0 0 50 18 1 0 4
display 1b 3a c8 01
display 1b 21
```

Let's attack this procedure file from the top. The first line terminates the window we have been working in. OS-9 does not allow you to have more than one window with the same name. Use the display command to send the hexadecimal characters 1b 24 to the stand-ard output path, which just happens to be window device /w1. Those codes, 1b 24, activate the OS-9 Device Window End call. As soon as they are received, the window disappears.

In the next line the display command sends the Device Window Set command and creates an 80-by-24, four-color graphics window. Characters are blue on a white background; the border is red. Since you are in a graphics window, tell OS-9 which font to use in the next line. Essentially the C8 01 tells the system to use the characters in Group 200, Buffer 1. These characters must be merged into the system from the file stdfonts in the SYS directory. Most people take care of this in the startup file. Buffer 1 contains the standard 8-by-8 pixel font.

Now that you have created a window and picked a set of fonts, you must select that window and tell the system to use it. The 1b 21 code in the next line activates the OS-9 Window Select Call.

Color #	Color
0	White
1	Blue
2	Black
3	Green
4	Red
5	Yellow
6	Magenta
7	Cyan
8	White
9	Blue
10	Black
11	Green
12	Red
13	Yellow
14	Magenta
15	Cyan

Table 2: Available Colors

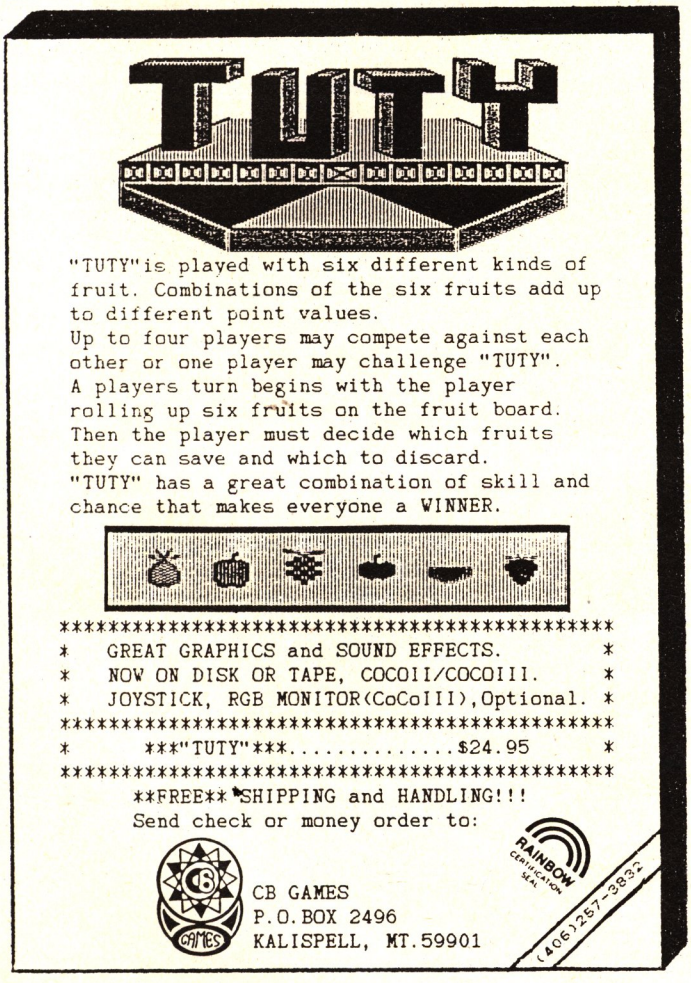
```
link shell
load utils
montype r
date t
iniz w7
echo merging fonts
merge /dd/sys/stdfonts >/w7
echo merging pointers
merge /dd/sys/stdptrs >/w7
echo merging patterns
merge /dd/sys/stdpats_2 >/w7
merge /dd/sys/stdpats_4 >/w7
merge /dd/sys/stdpats_16 >/w7
shell i=/w7&
echo creating 80 column text window in TERM
merge mtw >/term
control -e
echo Starting Basic09
load basic09
load runb
iniz w1
display 1b 20 7 0 0 50 18 2 0 2 >/w1
basic09 #24K <>>>/w1&
echo Starting word processor
load ds
iniz w4
display 1b 20 2 0 0 50 18 1 0 2 >/w4
ds <>>> /w4&
echo Starting graphics program
load MVCanvas
MVCanvas <>>>/w&
```

Figure 1: Sample Startup File

You can execute the commands in the procedure file `makegw` in several ways. To use the first method, press CLEAR and move to window `/w1`. From the command line, type `makegw`. The file `makegw` must be located in the current data directory used by *this* shell. If it isn't, you need to type the complete pathlist to the file.

Next, save the output of the procedure file `makegw` in another file. You can then merge these codes into any window and make the changes instantly. To create the file containing these codes, use the following command line: `makegw >mgw`. Now anytime you want to change the window you're working in to an 80-by-24, four-color window, just type `merge mgw`. You can even change a window you're not working in by redirecting the output of the `merge` command.

For example, to change window device `/w4` to a four-color graphics window while you continue to work in the `/term` device window, type `merge mgw >/w4`. This is one of the fastest ways to change a window from one type to another. I keep three of these files — `mtw`, `mgw5` and `mgw7` — in my root directory, `/dd`, at all times. By doing this I can be seven directory levels down working on a program and still change the type of the window I'm working in by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typing `merge /dd/mtw`. The `mtw` stands for make text window, `mgw5` changes a window to a two-color, 80-by-24 graphics window, and `mgw7` turns a window into a four-color graphics window.

Another way to accomplish the same thing is to use only one `display` command with all the parameters used above trailing it. This gives you a way to send the commands interactively from within the window you are changing. To do this, use the CLEAR key to get to window `/w1` and issue the following command line:

```
display 1b 24 1b 20 7 0 0 50 18 1 0 4
1b 3a c8 01 1b 21 1b 32 1
```

A Sample Startup File

A sample `startup` file you can use to boot your system with BASIC09, a drawing program and your word processor while two shells wait in the wings for additional action is shown in Figure 1. You can move to any of the three application programs or two shells by pressing CLEAR until the proper window appears.

Most of the `startup` file above is pretty straightforward; however, several points need to be addressed. First, my `OS9Boot` file is set up with the `/term` descriptor as a window instead of the VDG screen version of `/term` in the original `OS9Boot`. The module containing the window version of `/term` is in the modules directory that comes with your system.

I use the command `control-e` to run the corresponding program from the *Multi-Vue* package. This command line reads the *Multi-Vue* environment file, `env.file`, which sets quite a few system parameters automatically. It also starts my Hi-Res mouse automatically and saves a lot of hassle when I try to run a program that assumes the mouse is already turned on.

You can substitute the proper commands to load and start your favorite word processor where I loaded and started *DynaStar*. Notice that I started *DynaStar* in an 80-by-24 text window because that is what the program requires. I start BASIC09 in a four-color, 80-by-24 graphics window because I experiment with graphics programs more than any other type.

I initialize and generate the proper type window for both BASIC09 and *DynaStar* specifically. But because *MVCanvas* kills the window it is started in and creates its own window of the proper type automatically, I am able to use the more generic `/w` descriptor and start the program in the next available window.

After you boot with this `startup` file, you are able to move to any one of the three application programs or two shells with the CLEAR key. One additional precaution is in order here. Since the whole point is to leave all three applications running and instantly available a CLEAR key away, you must make sure not to quit any of the application programs by the normal route.

For example, never type `BYE` or put that command in one of your BASIC09 programs. Otherwise, BASIC09 terminates and the window you run it in disappears from your screen until you manually start it again. Likewise, make sure you never type CTRL-BREAK to generate the EOF condition from within BASIC09. Instead, when you are finished using BASIC09 for the minute, press CLEAR to move to your next application. BASIC09 continues to run in the window you just left and is ready and at your command when you return later.

The same precautions must be taken with your word processor and graphics program. Instead of telling the word processor to save the file and exit to the shell, tell it to write the file to disk and return to its own menu. Do the same with your graphics program.

The OS-9 Spotlight returns next month. Until then, keep on hacking!

Novices Niche

Graphics CoCo 3

Spiral

by John Mosley

While doodling on a piece of paper, I noticed that some very interesting shapes could be made by drawing triangles inside other triangles, rotating them as I went along. I decided to see what the computer could do with this. To see what I mean, enter the listing, save it and type `RUN"SPIRAL`. Just enter the number of sides you want and wait a few moments while it computes points. This program can be converted to work on a CoCo 2 by changing the graphics statements. Have fun!

The Listing: `SPIRAL`

```
0 ' COPYRIGHT 1990  FALSOFT,INC
10 DIMX(20,20),Y(20,20)
20 CLS:INPUT"NUMBER OF SIDES (3-
20):";Z
30 IF Z<3 OR Z>20 THEN 20
40 HSCREEN2:POKE65497,0:PALETTE0
,0:PALETTE15,63:HCLS0:HCOLOR15
50 V=57.2957795
60 B=-10:W=360/Z
70 A=0
80 FORT=1 TO 20
90 B=B+(Z-2)*3
100 A=A+T/2.2
110 FORU=1 TO Z
120 X(U,T)=1.1*A*COS((B+(U*W))/V
)+160
130 Y(U,T)=A*SIN((B+(U*W))/V)+96
140 NEXTU,T
150 SOUND 1,1
160 FORT=1 TO 20
170 HLINE(X(1,T),Y(1,T))-(X(1,T)
,Y(1,T)),PSET
180 FORU=1 TO Z
190 HLINE-(X(U,T),Y(U,T)),PSET
200 NEXTU
210 HLINE-(X(1,T),Y(1,T)),PSET
220 NEXTT
230 EXEC44539:HSCREEN0:RUN
```

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- **Set #6** Block and Computer;
- **Set #7** Small: Roman, Italics, Cubes, etc;
- **Set #8** Novelty fonts;
- **Set #9** Gallant and Spartan;
- **Set #10** Several Roman fonts;
- **Set #11** Gothic and Script;
- **Set #12** More Roman and Italic;
- **Set #13** Several Courier fonts;
- **Set #14** Modern and Screen;
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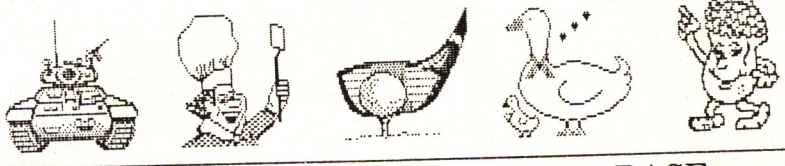

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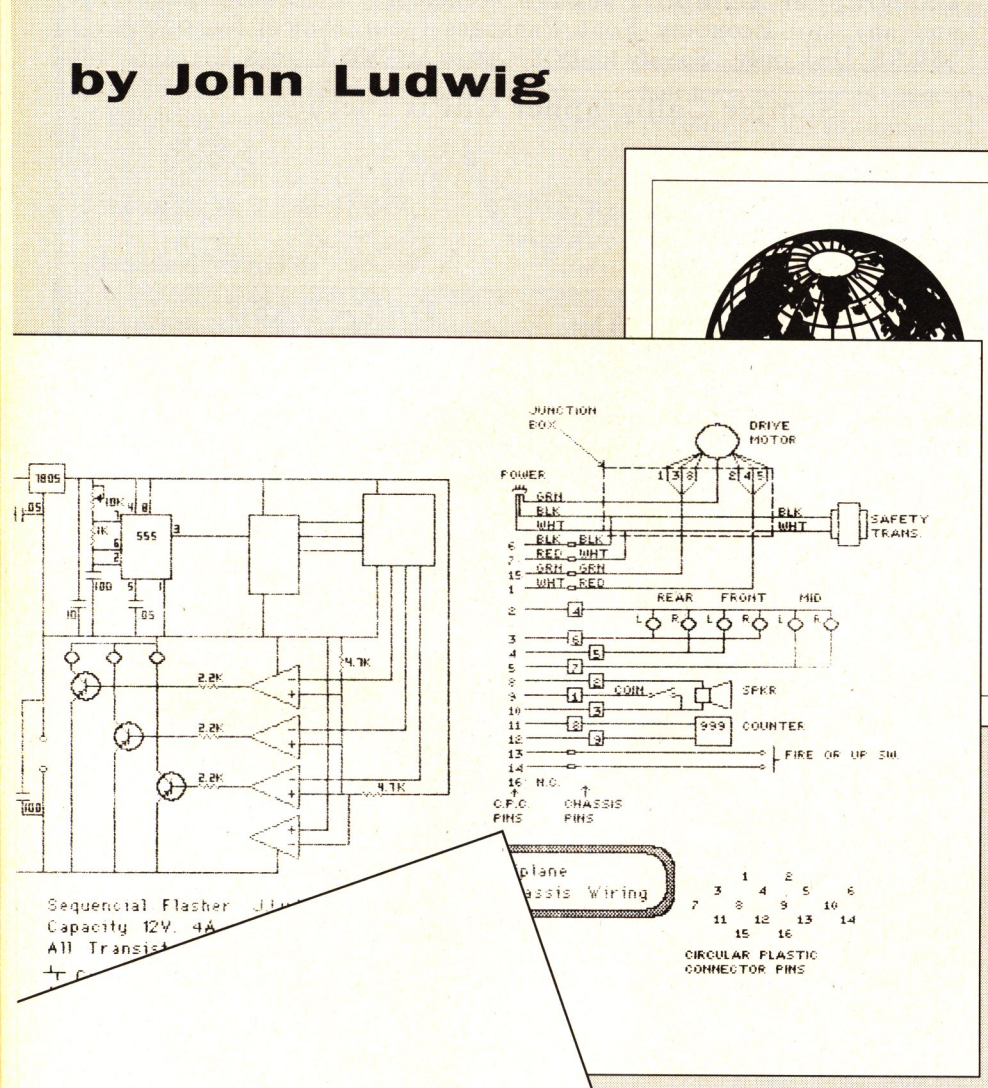
Doublewide

by John Ludwig



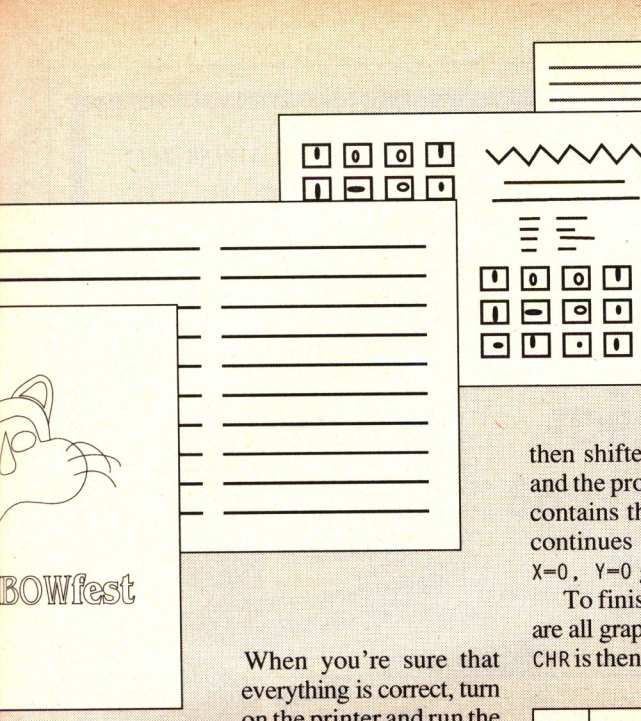
A program that prints double graphics screens side-by-side.

This utility is for you if you've ever wished you could print 16 pages of PMODE4 screens. *Doublewide* lets you load two 8-page screens into memory and then select bold, double-strike, both or normal print. The program requires a DMP-105 or DMP-106 printer. It prints the screens side-by-side with anywhere from zero to 20 pixels between them. With no spacing, the resolution is 512 dots wide and 384 dots high. I have found it to be useful for printing two wiring diagrams on the same page. In my work, this saves on the cost of photocopies for distribution.

To prepare the program, the BASIC lines should be typed and saved. Then you have two choices:

- Type in CREATE and run it.
- Use an editor-assembler to copy the source listing, assemble it and write it on the disk.

John Ludwig has a degree in electronics and works as a repair technician for MCBIZ Corporation. He has owned a CoCo 2 for two years. You can reach John at 125 W. 8th St., Coal Valley, IL 61240.



When you're sure that everything is correct, turn on the printer and run the program.

Doublewide serves many functions:

- reserves memory for the Hi-Res screens and string storage.
- creates four strings of 128 characters each: A$, B$, C$ and D$.
- loads the machine-language subroutine that not-so-magically transforms the four strings into the image that will be printed.
- tells the subroutine where the strings begin in memory.
- asks you which screens to load or displays a directory, and then loads the screens.
- asks you to select bold, double-strike, both or normal and then it sets the printer accordingly.
- executes the subroutine 55 times and prints all of the strings each time.
- it returns the printer to normal text and then ends.

The Subroutine

In order for the dots on each screen to become the correct characters for the printer, the subroutine must examine the correct bit and type to determine if each bit is reset on the screen. If so, the subroutine must set the bit in the printer character. The printer is capable of printing an area seven dots high and, in the elite (compressed) mode, 576 dots wide. For two screens we only need 512 dots.

To show how the subroutine operates, let's consider the printer character to be eight bits high with all bits reset to begin. Because we are going to test only one bit at a time, we need a mask that will serve to ignore the other bits in each byte, with which we are not concerned yet.

The byte on the screen that contains the dot at X=0, Y=6 is brought into a register and complimented. That is, all zeros become ones and all ones become zeros. Then the byte is compared with the mask. If the bit was set, we set Bit 0 in the printer character (CHR). CHR is then shifted one bit down (left, actually), and the process is repeated for the byte that contains the bit at X=0, Y=5. The process continues for each dot from X=0, Y=6 to X=0, Y=0 going up.

To finish the first CHR, Bit 7 is set just as are all graphics characters sent to the printer. CHR is then stored in the current string using the current string pointer added to the value of the character counter. The mask is then shifted one bit right to be used to examine Bit 6 in each of the same seven bytes used before.

In this way an area of eight dots wide-by-seven dots high form the first eight graphics characters printed in each line. This process is repeated across the left screen (stored at the normal graphics memory location), then across the right screen (stored in high memory).

When the subroutine returns to BASIC, the strings have been converted to the appropriate image for printing. The subroutine remembers where it must start the next row.

When the subroutine prints the last seven rows of both screens, it ignores the last row, because the bottom row of the last pass isn't part of the graphics screen. ❑

32K Disk

Listing 1: DBLWIDE

```
00010 *************************
00020 *  DBLWIDE  BY J LUDWIG *
00030 *  SUBROUTINE TO DEFINE *
00040 *  THE STRINGS FOR      *
00050 *  DBLWIDE/BAS PROGRAM  *
00060 *************************
00070          ORG $7D00
00080 ACTBAS   FDB 0       BASE OF CURRENT 7 LINES
00090 LOBASE   FDB $0E00   BASE ON THE LEFT SCREEN
00100 HIBASE   FDB $4D00   BASE ON THE RIGHT SCREEN
00110 ADDRES   FDB 0       ACTUAL ADDRESS OF CURRENT STRING
00120 CHRCTR   FCB 0       POSITION IN STRING
00130 STRIX    FCB 0       STRING INDEX.EQUALS 0,2,4,6 OR 8
00140 CHR      FCB 0       CHAR TO PUT IN THE STRING
00150 REPCTR   FCB 0       NO.OF DOTS TO READ, THIS MASK
00160 SHFCTR   FCB 0       SHIFTCOUNTER FOR MULTIPLY
00170 MASK     FCB 0       ANDED WITH SCREEN TO LOOK AT 1 PIXEL
00180 VARPRS   RMB 8       RESERVE 8 BYTES FOR VARPTRS
00190 ENTER    CLR STRIX   START NEW STRINGS
00200          LDY LOBASE SELECT LEFT SCREEN
00210          STY ACTBAS
00220 RET1     CLR CHRCTR NEW STRING
00230          LDB STRIX  SET NEW ADDRESS TO STORE CHR
00240          LDX #$7D0E
00250          ABX
00260          STX ADDRES
00270 RET2     LDA #128   START NEW BYTE
00280          STA MASK
00290 RET3     LDB #7     REPCTR=7
00300          STB REPCTR
00310          LDX #$3D40 CHECK FOR LAST 7 LINES
00320          CMPX LOBASE
00330          BEQ NOSET  IF SO, SKIP BIT 6
00340 RET4     LSL CHR
00350          LDB #5     ADDRESS=(REPCTR-1)*32+ACTBAS
00360          STB SHFCTR
00370          LDB REPCTR
00380          DECB
00390 RET5     ASLB       (MULTIPLY BY 32)
00400          DEC SHFCTR
00410          BNE RET5
00420          LDX ACTBAS (ADD ACTBAS)
00430          ABX        X=ADDRESS
00440          LDB ,X     PICK UP THE SCREEN BYTE
```

```
00450          COMB       INVERT IT FOR PRINTING
00460          ANDB MASK
00470          BEQ NOSET
00480          INC CHR    SET BIT Ø
00490 NOSET    DEC REPCTR
00500          BNE RET4   NEXT REP IF NOT DONE
00510          LDB #128   SET BIT7
00520          ORB CHR    OR AND STORE
00530          STB CHR
00540          LDX [ADDRES] ADDRESS = [STRIX+$7DØE]+CHRCTR
00550          LDB CHRCTR
00560          ABX
00570          LDB CHR    STORE CHR IN THE STRING
00580          STB ,X
00590          INC CHRCTR
00600          CLR CHR
00610          LSRA       SHIFT THE MASK BIT RIGHT
00620          STA MASK   STORE IT
00630          CMPA #Ø    DONE WITH MASKING YET?
00640          BNE RET3
00650          LDY ACTBAS INCREMENT THE ACTIVE BASE
00660          LEAY 1,Y
00670          STY ACTBAS
00680          LDB CHRCTR
00690          CMPB #$8Ø  END OF STRING YET?
00700          BNE RET2
00710          INC STRIX
00720          INC STRIX
00730          LDB STRIX
00740          CMPB #4    READY TO CHANGE SCREENS?
00750          BEQ TOGGLE
00760          CMPB #8    DONE WITH SECOND SCREEN?
00770          LBNE RET1  IF NOT,START NEW STRING
00780          LDY HIBASE SET FOR NEXT 7 LINES
00790          LEAY 224,Y
00800          STY HIBASE
00810          LDY LOBASE
00820          LEAY 224,Y
00830          STY LOBASE
00840          RTS
00850 TOGGLE   LDY HIBASE SELECT RIGHT SCREEN
00860          STY ACTBAS
00870          JMP RET1
00880          END
```

```
2Ø ..... 1Ø1
7Ø ..... 144
13Ø ..... 235
2ØØ ..... 27
25Ø ..... 146
END ..... 57
```

Listing 2: DWIDEBAS

```
Ø ' COPYRIGHT 199Ø FALSOFT, INC
1 'DBLWIDE BY JOHN LUDWIG
2 '           COAL VALLEY,ILL.
3 'A PROGRAM TO PRINT
4 'DOUBLE-SIZED GRAPHICS
5 'SCREENS, SIDE BY SIDE
6 'FOR COCO 1,2,3
7 'REQUIRES 32K AND DMP1Ø5 OR DM
P1Ø6
8 'PROGRAMMED FOR DISK DRIVE
1Ø PCLEAR8:CLEAR1Ø24,19712:DIMP(
6):DIMM$(7)'IT'S GOING TO BE A F
ULL COMPUTER
2Ø M$(1)="NAME OF THE ":M$(2)="L
EFT ":M$(3)="RIGHT ":M$(4)="Ø FO
R DIRECTORY":M$(5)="SCREEN":M$(6
)="NO. OF PIXELS BETWEEN SCREENS
":M$(7)="(Ø TO 2Ø)"
3Ø IFPEEK(&H7D16) <>127THENLOADM
"DBLWIDE"'IF SUB NOT IN MEMORY,
GET IT
4Ø CLS:PRINT"INITIALIZING VARIAB
LES"
5Ø FORR=1 TO128:A$=A$+" ":B$=B$+
" ":C$=C$+" ":D$=D$+" ":NEXT
6Ø DATA14,Ø,14,Ø,77,Ø
7Ø RESTORE:FORR=ØTO5:READD:POKE&
H7DØØ+R,D:NEXT'SET UP STARTS FOR
 SUBROUTINE
8Ø P(Ø)=VARPTR(A$)+2:P(2)=VARPTR
(B$)+2:P(4)=VARPTR(C$)+2:P(6)=VA
RPTR(D$)+2'FIND STRINGS
9Ø B=&H7DØE:FORR=Ø TO6STEP2:POKE
B+R,PEEK(P(R)):POKEB+R+1,PEEK(P(
R)+1):NEXT'GIVE POINTERS TO SUBR
OUTINE
1ØØ CLS
11Ø GOSUB28Ø:GOSUB3ØØ:IFT$="Ø"TH
ENDIR:GOTO11Ø
12Ø LOADMT$
13Ø GOSUB29Ø:GOSUB3ØØ:IFT$="Ø"TH
ENDIR:GOTO13Ø
14Ø LOADMT$,16128
15Ø PRINTM$(6):PRINTM$(7):INPUTS
16Ø S$="":FORR=Ø TOS:S$=S$+CHR$(
128):NEXT
17Ø INPUT"PRINT BOLD (Y OR N)";B
Ø$
18Ø INPUT"PRINT DOUBLE-STRIKE (Y
 OR N)";DS$
19Ø PMODE4,1:SCREEN1,1:PRINT#-2,
CHR$(3Ø);CHR$(27);CHR$(23)'DISPL
AY GRAPHICS,SELECT TEXT,ELITE
2ØØ IFBO$="Y"THENPRINT#-2,CHR$(2
7);CHR$(31);:GOTO22Ø'START BOLD
21Ø PRINT#-2,CHR$(27);CHR$(32);'
END BOLD
22Ø IFDS$="Y"THENPRINT#-2,CHR$(2
7);CHR$(21);CHR$(18):GOTO25Ø'NO
LF ON CR, SET GRAPHICS
23Ø PRINT#-2,CHR$(27);CHR$(22);C
HR$(18)'LF ON CR, SET GRAPICS
24Ø FORR=1 TO55:EXEC&H7D16:PRINT
#-2,A$;B$;S$;C$;D$:NEXT:GOTO27Ø
25Ø FORR=1 TO55:EXEC&H7D16:PRINT
#-2,A$;B$;S$;C$;D$;CHR$(13);A$;B
$;S$;C$;D$;CHR$(13);CHR$(1Ø):NEX
T
26Ø 'SELECT TEXT,     STD CHARAC
TER SET,LINEFEED ON CR,   END BO
LD.
27Ø PRINT#-2,CHR$(3Ø);CHR$(27);C
HR$(19);CHR$(27);CHR$(22);CHR$(2
7);CHR$(32):END
28Ø PRINTM$(1);M$(2);M$(5):PRINT
M$(4):RETURN
29Ø PRINTM$(1);M$(3);M$(5):PRINT
M$(4):RETURN
3ØØ INPUTT$:RETURN
```

```
5Ø ..... 1Ø4
END ..... 75
```

Listing 3: CREATE

```
Ø ' COPYRIGHT 199Ø FALSOFT, INC
1Ø 'A PROGRAM TO CREATE THE DBLW
IDE.BIN SUBROUTINE
2Ø FORA=32ØØØ TO322Ø8:READD:POKE
A,D:NEXT
3Ø SAVEM"DBLWIDE",&H7DØØ,&H7DDØ,
&H7D16
4Ø DATAØ,Ø,14,Ø,77,Ø,Ø,Ø,Ø,Ø,Ø,Ø
,Ø,Ø,Ø,1,Ø,1,Ø,1,Ø,1,127,125,9,1
6,19Ø,125,2,16,191,125,Ø,127,125
,8,246,125,9,142,125,14,58,191,1
25,6,134,128,183,125,13,198,7,24
7,125,11,142,61
5Ø DATA64,188,125,2,39,33,12Ø,12
5,1Ø,198,5,247,125,12,246,125,11
,9Ø,88,122,125,12,38,25Ø,19Ø,125
,Ø,58,23Ø,132,83,244,125,13,39,3
,124,125,1Ø,122,125,11,38,218,19
8,128,25Ø,125,1Ø,247,125,1Ø,174,
159,125,6,246,125,8,58,246
6Ø DATA125,1Ø,231,132,124,125,8,
127,125,1Ø,68,183,125,13,129,Ø,3
8,17Ø,16,19Ø,125,Ø,49,33,16,191,
125,Ø,246,125,8,193,128,38,148,1
24,125,9,124,125,9,246,125,9,193
,4,39,31,193,8,16,38,255,116,16,
19Ø,125,4,49,169
7Ø DATAØ,224,16,191,125,4,16,19Ø
,125,2,49,169,Ø,224,16,191,125,2
,57,16,19Ø,125,4,16,191,125,Ø,12
6,125,33
```

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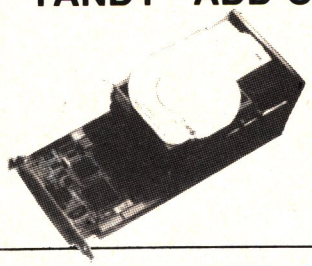

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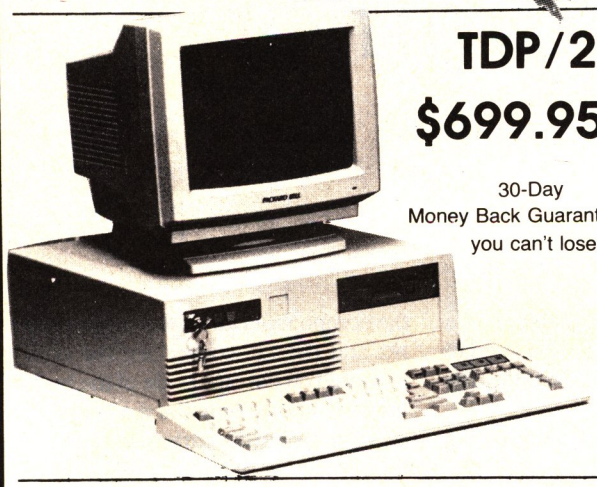

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Build Your Own EPROM Programmer

by Tony DiStefano
Contributing Editor

Enough of the basics! It's time to sink your teeth into a real project — an EPROM programmer. Though not a fancy, high-priced project, the end product (known as the MPROM programmer and sold by DISTO) can program three types of EPROMs. Make sure it can program the EPROM you need before you start. If you understand my last several articles, this project should go fine.

The programmer can program the following types of EPROMs: a 2764, which is an 8K EPROM on a 28-pin chip; a 27128, which is a 28-pin EPROM with a 16K capacity (Remember, the CoCo 1 and 2 do not use the last 256 bytes of the EPROM if you use it in a Disk Controller. In the CoCo 3, the unusable area is normally 512 bytes, but it has a way of being able to access it.); and a 27256, which is a 32K EPROM that resides in a 28-pin socket and can be used in a controller with a 28-pin socket.

The 27256 can only be programmed 16K at a time. This requires two passes with the programmer. With a CoCo 1 or 2, it can only be used one half at a time, but if you know what you are doing, you can add a switch and access both halves separately. With the CoCo 3, you can access the whole thing by whispering special codes to the GIME chip.

If you'd like to use any of these chips, this project will help you program them.

Programmer Construction

Figure 1 shows the complete schematic for the EPROM Programmer. Table 1 is a complete parts list. Obviously you need to get all the parts before you start building the programmer.

Cut the proto-board to about 3¼-inch square. Figure 2 shows where to place the connectors and ICs. Remember, if this is to fit in your DISTO controller, you must put some components on one side of the board and others on the other side. The diagram in Figure 2 is shown at the top of the board. In other words, looking at the IC numbers, all the components go on top of the board. JP1, JP2 and the ZIF socket are the only parts mounted on the other side of the board. The diagram shows only the major parts; place all of the smaller parts wherever they fit. Remember to place the smaller components close to where they are connected. This keeps your wiring short.

I did not mention sockets in the parts list. Some people like to solder the ICs directly to their board, some like to wire-wrap it, and others like to use sockets. It's

Quantity	Reference	Part
1	C1	100µF @ 50 Volts
1	C2	10µF @ 50 Volts
1	D1	1N4004
1	D2	1N5817
1	JP1	2 pin angled Header
1	JP2	3 pin straight Header
1	JP3	17 pin Female Header
2	Q1,2	2N3906
4	R1,2,3,6	4.7K 1/4 Watt
1	R4	
1	R5	
1	R7,8	10K 1/4 Watt
1	R9	
1	U1	74LS244
1	U2	74LS374
1	U3	74LS273
1	U4	74LS138
1	U5	CD4040 or 74HC4040
1	U6	7406
1	U7	28 pin ZIF Socket
1	U8	LM317 Regulator
6	—	.1 µF 25 Volts

Misc: Proto-board, wire, sockets, batteries and caps or adapter, solder, EPROMs.

Table 1: Parts List

Tony DiStefano is a well-known early specialist in computer hardware projects. He lives in Laval Ouest, Quebec. Tony's username on Delphi is DISTO.

really up to you. Usually I use sockets. If you want to, just get the proper amounts and sizes.

Not shown in the schematic diagram is the V_{CC} (+5 Volts) and GND (Ground) of each IC. The following is a list of V_{CC} and GND for each IC:

IC#	V_{CC}	GND
U1	20	10
U2	20	10
U3	20	10
U4	16	8
U5	16	8
U6	14	7
U7	None	14

Also in the parts list are six capacitors. Place one as close as possible to each of the six ICs on the board. They connect from V_{CC} to GND on each.

EPROM Programming

A new or erased EPROM has all the same data in each cell — all $FFs or, in binary, all 1s. The EPROM programmer changes a 1 into a 0, but it cannot do the opposite. Once a 0 is in an EPROM, the only way to change it back to 1 is to erase it, which can usually only be done with an EPROM eraser. Ultraviolet light erases an EPROM. So anything that generates UV erases an EPROM, so to speak. It's just a matter of time. For instance, the sun has UV and therefore can erase an EPROM, only it takes about a day. Neon lamps can do it in about a week. A proper UV EPROM eraser can handle the job in about seven minutes.

Pin Name	MEB Pin#	CoCo Pin#
D0	5	10
D1	6	11
D2	7	12
D3	8	13
D4	9	14
D5	10	15
D6	11	16
D7	12	17
A0	3	19
A1	4	20
A2	17	21
R/*W	15	18
E	2	16
*CE	13	36
+5V	16	9
GND	14	33

Table 2: System Pinouts

To program the EPROM requires hardware. Start powering the device by putting +5 Volts to V_{CC}. Then you must give it a stable address. It doesn't have to start with Address 0, but most programmers start there. Valid data must also be present at the data lines. This may be a little different for every EPROM, but the theory is basically the same.

The V_{PP} pin is the programming voltage. Depending on the EPROM being programmed, this voltage can be +12.5 volts, +21 volts or +25 volts; the older chips 25 volts and the newer ones mostly 12.5 volts.

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Corrections

The Assembly Line, Part I" (May 1990, Page 22): To correct a minor problem with large magnifications, add Line 645 and change Line 650 in Listing 2 as follows:

```
645     CLRA
650     LDB     D,U
```

Change Line 10 in Listing 3 to:

```
10 CLEAR 200,&H6000-1:CO=&H61B6
```


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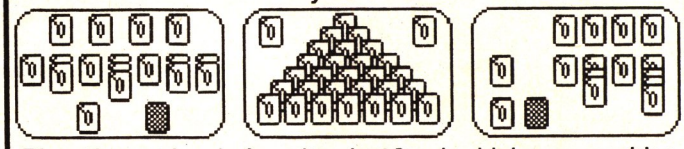

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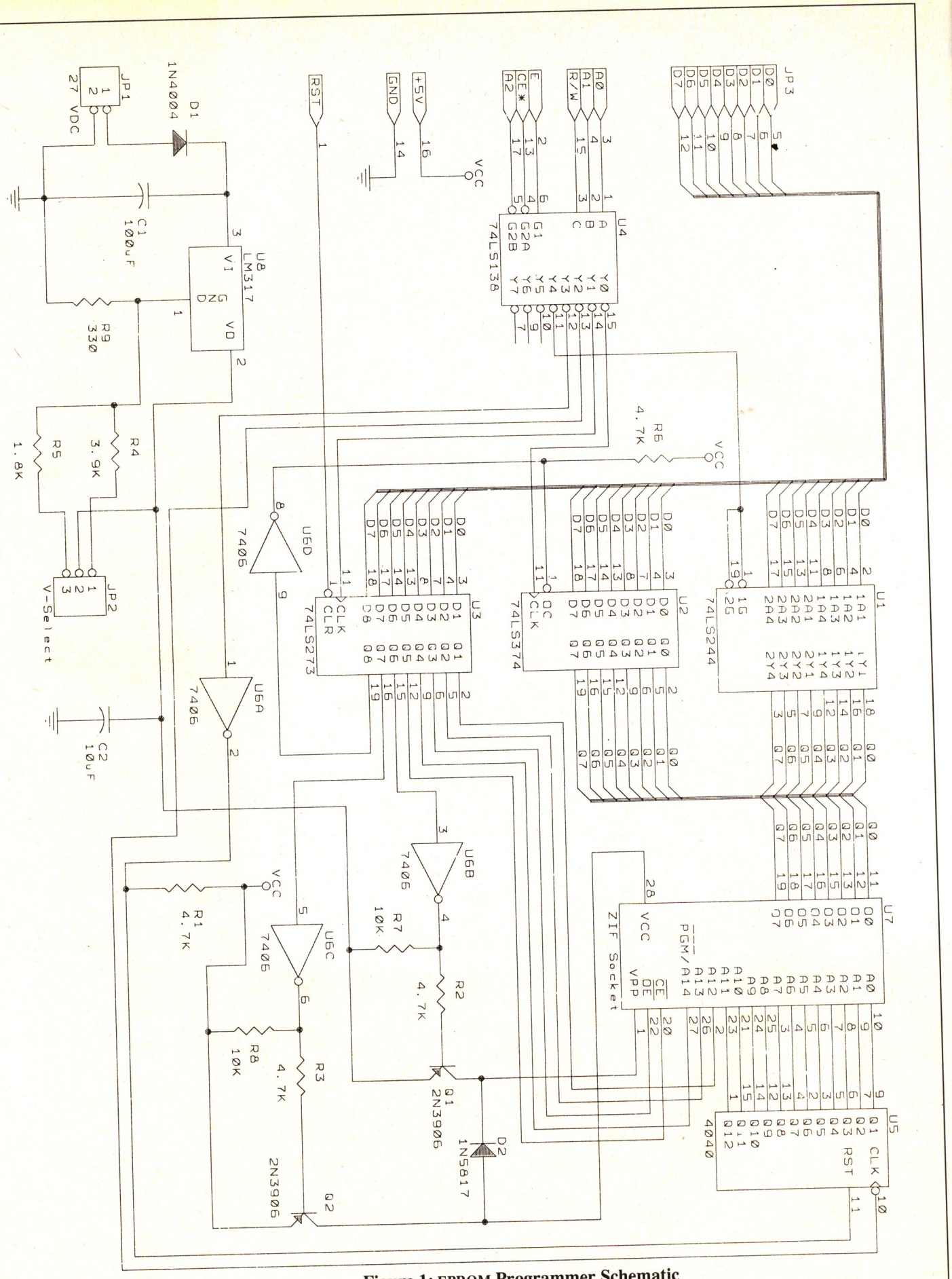


Figure 1: EPROM Programmer Schematic

Expand your CoCo's capabilities. And, monthly

The EPROMs that work on this programmer use only the 12.5- and the 21-volt kind. After the V_{PP} voltage is applied, a programming pulse is required.

Again, there is a difference between the older and newer type chips. The older ones such as the 2708 or 2716 (1K and 2K EPROMs) require that the programming pulse width (duration of the pulse) be 50 ms. Fifty milliseconds does not seem long and to program 1K and 2K EPROMs, it isn't. That's only 50 seconds for a 1K EPROM. This programmer can program a 27256 32K EPROM in about one hour. New internal programming circuits allow for shorter programming times.

Using 2764s or greater reduces the time required to program an EPROM. It involves a short algorithm. Most programmers on the market today use this method, but some do so incorrectly. When you see ads for programmers that claim to program an EPROM in "seconds," chances are they are not programming the EPROM long enough, even though the device seems to work properly. The device may lose information prematurely or not meet specs on access speed. Now I'll explain the proper algorithm to use when programming an EPROM using less than 50ms.

Start the programming by raising V_{PP} to the proper voltage. With stable address and data on the EPROM, a 1ms pulse is applied to the PGM pin (program pin). The EPROM is then verified for proper data at that location. This 1ms pulse is repeated until the selected address is correct. Then a final pulse that is four times the duration of the total amount of pulses required for proper operation is given to the EPROM. In other words, if it took three pulses to program that location, the final insurance pulse should be 3*4, or 12ms. Most of the time, however, only one pulse is required; therefore the final pulse is only 4ms, giving the total pulse width of 5ms. That's 10 times shorter to program. The bigger EPROMs require even less time to program. After that address is programmed, the next location is programmed and so forth until all the desired locations are programmed. The EPROM must be completely verified when programming is done.

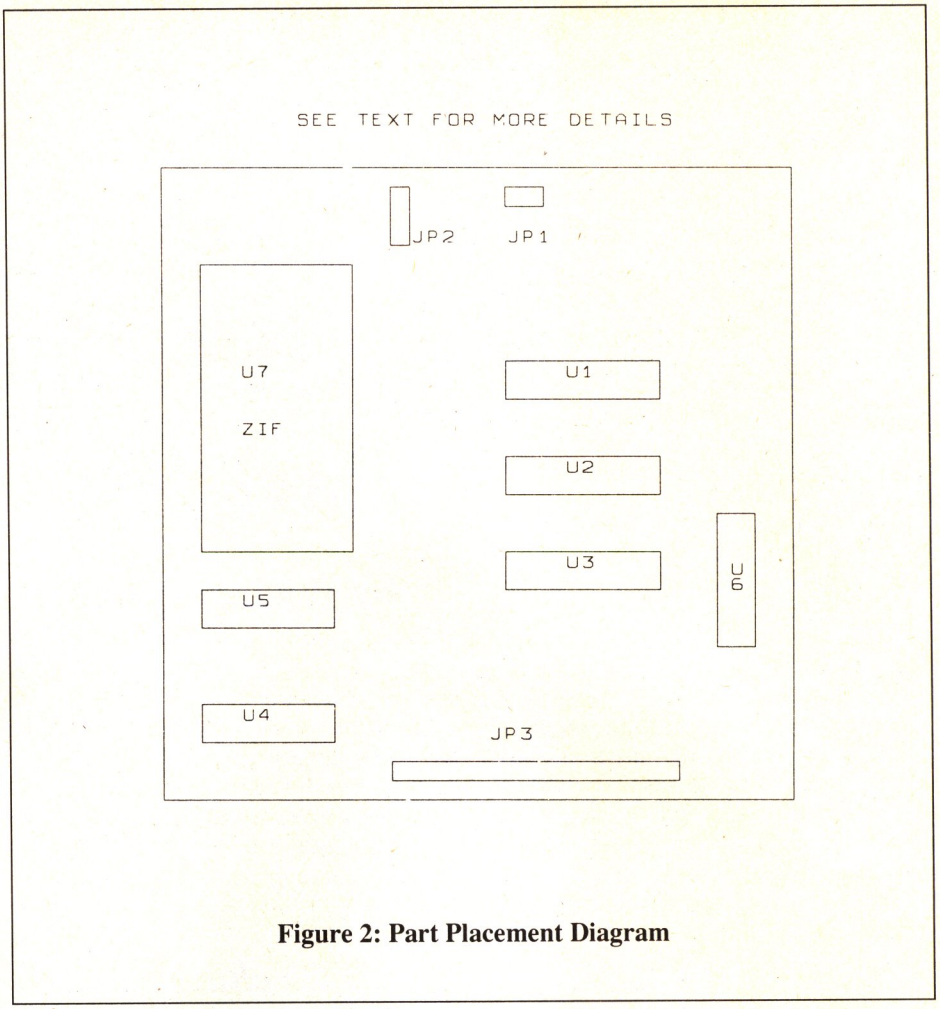
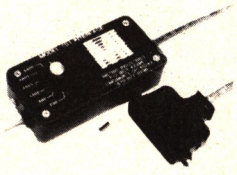


Figure 2: Part Placement Diagram

If you don't have a DISTO product that has an MEB adapter, you have to make a few changes to the diagram. All the connections to connector JP3 have to be changed to the CoCo's bus connector. You will need a standard CoCo proto-board such as the one CRC sells. Table 2 shows the different pin numbers required to wire the EPROM programmer to your CoCo's bus. The component layout is not so critical and may be done to your own preference.

Get your parts, put it together and check your work carefully. Don't attempt to put an EPROM into the socket until we run a few tests. Next month I'll go through a complete test and explain what each particular component is used for as well as testing and troubleshooting.



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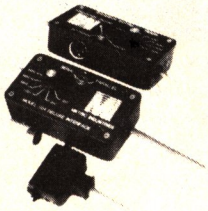

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The Assembly Line, Part III:

by William P. Nee

Remember the Spirograph™, a wheel within a wheel? If you inserted a pen and rotated the inside wheel, it created endless loops and circles. By changing wheel sizes and pen locations you could draw an infinite number of designs. You can do the same thing on the CoCo.

First let's see how to generate a simple design. The large, fixed wheel can have a radius that measures from r_1 to 99. The second wheel has a radius of r_2 and, because it fits inside the first wheel, must have a smaller radius than r_1; the difference between r_1 and r_2 is r. The distance your pen is from the center of the inside wheel is *di*. Since we're not actually using wheels, you can let this distance be greater than the inside wheel.

As the pen goes around inside Wheel 1, it generates an angle A_1 of 0 to 359 degrees; but it also generates another angle A_2 as it goes around the inside wheel. This angle is proportional to the two radii (r_1/r_2) so $A_2=A_1(r_1/r_2)$. The x location is:

$$r\cos(A_1)+di\cos(A_2)$$

and the y location is:

$$r\sin(A_1)-di\sin(A_2).$$

The number of loops the finished design has is the sum of both radii (r_1+r_2) divided by their GCD (greatest common denominator — the largest number that evenly divides into both r_1 and r_2). The number of 360-degree cycles it takes to complete the design is r_2/GCD.

CoCo churning, wheels spinning, ideas turning

Now for an example. Type in and run Listing 1. Since R1 is 90 and R2 is 45, their GCD is 45 (computed in lines 200 through 250); the design has (90+45)/45, or 3, loops and takes one 360-degree cycle to complete (MX). RA is a factor that converts angles to radians since the CoCo only computes the sine or cosine of angles in radian measure. After the x and y locations are derived, they are plotted relative to the center of the screen.

Takes a while, doesn't it? Try changing R1 in Line 20 to 80. Now it's going to take nine cycles to complete the drawing. Or, even worse, change R1 to 91 — if you wait for that one to finish, you'll end up glued to your chair. It takes a while because the CoCo has to compute the sine and cosine of A1 and A2 every time. Since SIN and COS are already ROM routines, you really wouldn't save much time by converting the program to machine language as it is; what's needed is a different approach.

At the end of the machine language program is a scaled table of sine values from 0 to 359 degrees. After converting degrees to radians, I multiplied each value by 256 to get a two-byte number; negative values all begin with $FF. Now, instead of multiplying we can just look up the sine in the table. This also works for cosines since the cosine of a number is the sine of that number plus 90 degrees. At this point we'd better look at the BASIC program (Listing 2) and see what changes were made to it.

Lines 10 through 200 set up the variables, check for proper values and return information about the display. The subroutine at Line 2000 draws three menu selections and saves them in the M array; the subroutine at Line 1500 computes the greatest common demoninator and the number of cycles. There are new options for rotating the entire display up to 359 degrees and for scaling values. Since we'll be using the joystick, FB corresponds to $FF00, the location giving the status of the fire button.

Lines 200 through 340 display all previous and current values. You can change any current value by moving the cursor over the desired number and pushing the fire button; each time you push it, that number increases by one. When all the new values have been set, move the cursor to the right and push the fire button. This copies the old display to pages 5 through 8 and then draws the new display on top of the old one.

The routine beginning at Line 600 scales and pokes all the current values into the machine-language program and executes it. If it is the eleventh display, that's the end of the program — otherwise lines 700 through 750 bring up three menu choices in the top-left corner along with a little arrow that you control with the joystick. Move the arrow over the desired option (only the available

Bill Nee reversed the snowbird trend by retiring to Wisconsin from a banking career in Florida. He spends the long, cold winters writing programs for his CoCo. He can be contacted at Rt. 2, Box 216C, Mason, WI 54856-9302.

ones will blink) and push the fire button. Menu options are:

- Change — list previous and current values; change current values
- Save — give the picture a name and save it to disk
- Undo — remove only the last display and its values

The subroutines at lines 3000 and 4000 print the information properly and compute the new values as you change their numbers.

The picture is saved in lines 800 through 840. The menu is removed and that part of the picture is replaced, then the extension .SPI is added to the picture name. Finally the routine at Line 900 copies the previous display from pages 5 through 8 to pages 1 through 4 and puts all current values back to their previous values. Type in and save Listing 2 as SPIRO. Now let's follow the machine language program (Listing 3) as it goes through its paces.

Space is reserved for all the variables in lines 110 through 220. The only variable to use floating-point math is DR (R1/R2) — all the rest are one or two bytes. The first number to be computed is R*COS(ANGLE1+ROTAT). After adding ANGLE1, ROTAT and 90 degrees, the value is doubled (because the sine table is made of two-byte numbers) and the Dth value in the sine table is stored in Register X with its sign (0 or #$FF) in SIGN1. Then the scaled R is multiplied by Register X and the result stored in NUM1. The second value to be computed is DIST*COS(ANGLE2+ROTAT). Again, after adding ANGLE2, ROTAT and 90 degrees, the result is doubled and the Dth value stored in Register X with its sign in SIGN2. The scaled DIST is then multiplied by the value in Register X.

Since the *x* location is the sum of these numbers, the result is added to NUM1, including the signs — actually, three-byte addition. SIGN1 and the first byte of NUM1 are the signed value of the new *x* location. Because we'll be adding 128 to this value later when we plot it, compare the new value to plus or minus 127. Any value outside this range is ignored since it would be off the screen; and we can then also bypass the *y* location computations.

The first number of the *y* location to compute is DIST*SIN(ANGLE2+ROTAT). After ROTAT is added to ANGLE2, the result is doubled, and the Dth value in the sine table stored in Register X. This value is multiplied by the scaled DIST and the result is stored in NUM1 with its sign in SIGN1. The second number is R*SIN(ANGLE1+ROTAT). ROTAT is added to ANGLE1, the result doubled, the Dth value stored in Register X and multiplied by scaled R.

Because the *y* location is the difference between these two numbers, NUM1 and its sign are subtracted. Since we will be subtracting this value later from 96 when we plot it, compare the new value to plus or minus 95 and discard any location outside this range.

The PSET routine (Line 1230) adds 128 to the *x* location and subtracts the *y* location from 96. The results are stored in locations $BE and $C0, and the ROM routine at $9374 sets the points. Then ANGLE1 is increased by one degree, multiplied by DR (that's R1/R2), and the result stored in ANGLE2. Finally, the running counter ACOUNT is increased by one. If it's greater than the maximum count we computed in the BASIC program, the display is complete. Otherwise a quick check can be made to see if you want to stop drawing (press any key to do this) and then it's on to the next *x* and *y* locations.

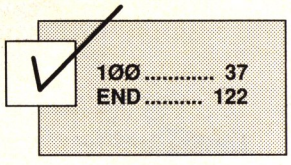
After you've typed in the source code, check for errors with A/NO/NS/WE. When it's error-free, save the code with W SPIRO.SRC and then assemble it with A SPIRO.BIN /NS/WE. The BASIC program will check to see if the machine language portion has already been loaded. If you use a fast poke, be sure to insert a slow poke just before saving any picture. Here's a demo that makes a pretty design:

R1	R2	DI	SC	DA
90	10	30	1.00	000
90	10	25	1.00	000
90	10	20	1.00	000
90	10	15	1.00	000
40	10	15	1.00	000
40	10	15	1.00	180
40	10	15	1.20	180
90	10	05	1.00	000
90	10	10	1.00	000

Don't forget that the program allows for just 10 changes. You could have more than this but then would only be able to save and display the last 10 changes for the print routine in lines 3000 through 4000 to work.

Some other suggestions are to use PMODE3 and allow for colored designs; you'd have to scale the *x* and *y* locations before using the PSET routine. How about adding a LOAD menu option that will load a previously saved picture (along with its last 10 changes)? You could also include Quit as a menu option or keypress check. In another article I'll show you how to do all the rest of the BASIC program (menu selection, joystick changes, etc.) in machine language. Until then, keep experimenting with this program and don't hesitate to be designing people. ❑

64K Disk



Listing 1: SPIRO1

```
0 ' COPYRIGHT 1990 FALSOFT, INC
10 CLS
20 R1=90:R2=45:DI=40
30 R=R1-R2:DR=R1/R2:RA=ATN(1)/45
```

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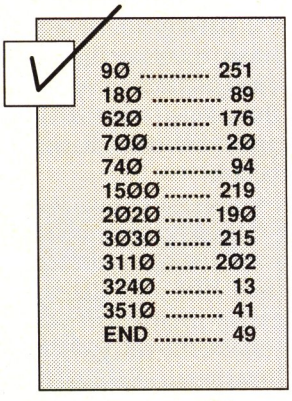
```
40 GOSUB 200
50 PRINT"SPIROGRAPHICS"
60 PRINT:PRINT"RADIUS OF WHEEL 1
 -";R1
70 PRINT"RADIUS OF WHEEL 2 -";R2
80 PRINT"DISTANCE ON WHEEL 2 -";
DI
90 PRINT
100 PRINT"THIS WILL HAVE"(R1+R2)
/J"LOOPS":PRINT" AND WILL TAKE"R
2/J"CYCLES"
110 PRINT:PRINT"PRESS ANY KEY TO
 START":EXEC &HADFB
120 PMODE4,1:PCLS:SCREEN1,1
130 FOR N=0 TO MX
140 A1=N:A2=A1*DR
150 X=R*COS(A1*RA)+DI*COS(A2*RA)
160 Y=R*SIN(A1*RA)-DI*SIN(A2*RA)
170 PSET(128+X,96-Y)
180 NEXT
190 GOTO 190
200 'GREATEST COMMON DENOMINATOR
210 I=R1:J=R2
220 IF I>=J THEN I=I-J:GOTO 220
230 IF I=0 THEN 250
240 TEMP=I:I=J:J=TEMP:GOTO 220
250 MX=(R2/J)*360:RETURN
```



Listing 2: SPIRO2

```
0 ' COPYRIGHT 1990 FALSOFT, INC
10 CLEAR 200,&H6000-1:IF PEEK(&H
6016)<>204 THEN LOADM"SPIRO"
20 PCLEAR8:DIM M(43),M1(10),M2(1
0),M3(10),P(43),P1(1),C(2),DR
30 CLS:PRINT"       SPIRO - GRA
PHICS"
40 FB=&HFF00:GOSUB 2000
50 M4=0:RA=ATN(1)/45:NN=0
60 PRINT:INPUT"RADIUS OF WHEEL O
NE    -";R1:R1=INT(ABS(R1))
70 IF R1>99 THEN R1=90
80 INPUT"RADIUS OF WHEEL TWO   -
";R2:R2=INT(ABS(R2))
90 IF R2>R1 THEN PRINT" MUST BE
LESS THAN WHEEL ONE":GOTO 80
100 R=R1-R2
110 INPUT"DISTANCE ON WHEEL TWO
-";DI:DI=INT(ABS(DI))
120 GOSUB 1500
130 INPUT"SCALE FACTOR [1] -";SC
:IF SC=0 THEN SC=1
140 SC=INT(ABS(SC)*100)/100
150 INPUT"ROTATE ENTIRE DISPLAY
[0] -";DA:IF DA<0 THEN DA=360+DA
160 IF ABS(DA)>359 THEN DA=0
170 PRINT:PRINT"THIS WILL HAVE"(
R1+R2)/J"LOOPS":PRINT"AND WILL
T
A    K    E    "    R    2    /
J"CYCLES":PRINT:PRINT:PRI
NT"PRESS ANY KEY TO BEGIN"
180 R1(0)=R1:R2(0)=R2:DI(0)=DI:S
C(0)=SC:DA(0)=DA
190 EXEC &HADFB:GOTO 600
200 M1=0
210 CLS:PRINT"  CURRENT DATA"
220 PRINT" <R1> <R2> <DI> <SC> <
DA> [OK]"
230 GOTO 3000
300 NN=NN+1
310 R1(NN)=R1:R2(NN)=R2:DI(NN)=D
I:SC(NN)=SC:DA(NN)=DA
320 PUT(0,0)-(47,35),P,PSET
330 PCOPY 1 TO 5:PCOPY 2 TO 6:PC
OPY 3 TO 7:PCOPY 4 TO 8:M3=1
340 GOTO 600
600 SCREEN 1,1
610 POKE &H6000,INT(R*SC+.5)
620 POKE &H6001,INT(DI*SC+.5)
630 DR=R1/R2:V=VARPTR(DR):FOR Q=
0 TO 4:POKE &H600D+Q,PEEK(V+Q):N
EXT
640 MSB=INT(MX/256):LSB=MX-MSB*2
56:POKE &H600A,MSB:POKE &H600B,L
SB
650 POKE &H600C,INT(SC*16)
660 MSB=INT(DA/256):LSB=DA-MSB*2
56:POKE &H6006,MSB:POKE &H6007,L
SB
670 EXEC &H6016
680 GET(0,0)-(47,35),P,G:PUT(0,0
)-(47,35),M,PSET:IF NN<10 THEN
7
00
690 GOTO 690
700 H=JOYSTK(0)*4:V=JOYSTK(1)*3
710 GET(H,V)-(H+7,V+7),P1,G:PUT(
H,V)-(H+7,V+7),C,OR:PUT(H,V)-(H+
7,V+7),P1,PSET
720 IF H<47 AND V<9 THEN GET(0,0
)-(47,8),M1:PUT(0,0)-(47,8),M1,P
R E S E T : P U T ( 0 , 0 ) -
(47,8),M1,PSET:IF
 PEEK(FB)=254 OR PEEK(FB)=126
TH
EN 200
730 IF H<47 AND V>8 AND V<17 THE
N GET(0,9)-(47,17),M2:PUT(0,9)-(
47,17),M2,PRESET:PUT(0,9)-(47,17
),M2,PSET:IF PEEK(FB)=254 OR PEE
K(FB)=126 THEN 800
740 IF M3=1 AND H<47 AND V>17 AN
D V<27 THEN GET(0,18)-(47,26),M3
: P U T ( 0 , 1 8 ) -
(47,26),M3,PRESET:PUT
(0,18)-(47,26),M3,PSET:IF PEEK(F
B)=254 OR PEEK(FB)=126 THEN 900
750 GOTO 700
800 CLS:LINEINPUT"FILENAME - ";
N$:VERIFYON:SCREEN1,1
810 N$=N$+"/SPI"
820 PUT(0,0)-(47,35),P,PSET
830 SAVEM N$,&HE00,&H25FF,&HE00
840 GOTO 680
900 PCOPY 5 TO 1:PCOPY 6 TO 2:PC
OPY 7 TO 3:PCOPY 8 TO 4
910 GET(0,0)-(47,35),P,G
920 PUT(0,0)-(47,35),M
930 NN=NN-1:M3=0
940 R1=R1(NN):R2=R2(NN):DI=DI(NN
):SC=SC(NN):DA=DA(NN)
950 GOTO 700
1500 I=R1:J=R2:IF I=0 OR J=0 THE
N RETURN
1510 IF I>=J THEN I=I-J:GOTO1510
1520 IF I=0 THEN 1540
1530 TEMP=I:I=J:J=TEMP:GOTO 1510
1540 MX=(R2/J)*360:R=R1-R2
1550 RETURN
2000 PMODE4,1:PCLS:DRAW"BM0,0;NR
2;ND2;BF1;F3":GET(0,0)-
(7,7),C,G
:PCLS:'CURSER
2010 DRAW"BM6,2;H1;L3;G1;D4;F1;R
3;E1;BD1;BR3;NU6;BU3;R5;NU3;D3;B
R3;U4;E2;R1;F2;D1;NL4;D3BR3;U6;F
5;NU5;D1;BR3;BU1;U4;E1;R4;BD3;NL
1;D3;NL4;BR3;U3;NR3;U3;R5;BD6;NL
5":'CHANGE
2020 DRAW"BM2,16;NH1;R4;H5;E1;R3
;F1;BD5;BR3;U4;E2;R1;F2;D1;NL4;D
3;BR3;BU6;M+2,+6;R1;M+2,-
6;BD6;B
R3;U3;NR3;U3;R5;BD6;L4":'SAVE
2030 DRAW"BM1,25;BU1;U5;BR5;D5;G
1;NL4;BR4;U6;F5;NU5;D1;BR3;NR4;U
6;R4;F1;D4;BD1;BR3;BU1;U4;E1;R3;
F1;D4;G1;L3":'UNDO
2040 GET(0,0)-(47,35),M,G:PCLS
2050 RETURN
3000 FOR T=0 TO NN:TT=T+2
3010 IF R1(T)<10 THEN PRINT@TT*3
2+2,USING"0#";R1(T);ELSE PRINT@T
T*32+2,USING"##";R1(T);
3020 IF R2(T)<10 THEN PRINT@TT*3
2+7,USING"0#";R2(T);ELSE PRINT@T
T*32+7,USING"##";R2(T);
3030 IF DI(T)<10 THEN PRINT@TT*3
2+12,USING"0#";DI(T);ELSE PRINT@
TT*32+12,USING"##";DI(T);
3040 PRINT@TT*32+16,USING"#.##";
SC(T);
3050 IF DA(T)>99 THEN PRINT@32*T
T+21,USING"###";DA(T);:GOTO 3080
3060 IF DA(T)>9 THEN PRINT@32*TT
+21,USING"0##";DA(T);:GOTO 3080
3070 PRINT@32*TT+21,USING"00#";D
A(T);
3080 NEXT:TT=(TT+1)*32:T=T-1
3090 IF R1(T)<10 THEN PRINT@TT+2
,USING"0#";R1(T);ELSE PRINT@TT+2
,USING"##";R1(T);
3100 IF R2(T)<10 THEN PRINT@TT+7
,USING"0#";R2(T);ELSE PRINT@TT+7
,USING"##";R2(T);
3110 IF DI(T)<10 THEN PRINT@TT+1
2,USING"0#";DI(T);ELSE PRINT@TT+
12,USING"##";DI(T);
3120 PRINT@TT+16,USING"#.##";SC(
T);
3130 IF DA(T)>99 THEN PRINT@TT+2
1,USING"###";DA(T);:GOTO 3160
3140 IF DA(T)>9 THEN PRINT@TT+21
,USING"0##";DA(T);:GOTO 3160
3150 PRINT@TT+21,USING"00#";DA(T
);
3160 L1=&H400+TT+2
3170 L2=&H400+TT+7
3180 L3=&H400+TT+12
3190 L4=&H400+TT+16
3200 L5=&H400+TT+21
3210 H=INT(JOYSTK(0)/2)
3220 LL=&H400+TT:LR=&H400+TT+31
3230 LO=&H400+TT+H
```

```
3240 VA=PEEK(LO):POKE LO,128:POK
E LL,41:POKE LR,40
3250 IF ((H>1 AND H<4) OR (H>6 A
ND H<9) OR (H>11 AND H<14) OR (H
=16 OR (H>17 AND H<20)) OR (H>20
 AND H<24)) AND (PEEK(FB)=254 OR
 PEEK(FB)=126) THEN VA=VA+1:IF
V
A>121 THEN VA=112
3260 POKE LO,VA:POKE LL,126:POKE
 LR,124:GOSUB 3500
3270 IF H>26 AND (PEEK(FB)=254 O
R PEEK(FB)=126) THEN GOSUB 4000
3280 GOTO 3210
3500 IF (H>1 AND H<4) THEN R1=10
*(PEEK(L1)-112)+(PEEK(L1+1)-
112)
:GOSUB 1500:RETURN
3510 IF (H>6 AND H<9) THEN R2=10
*(PEEK(L2)-112)+(PEEK(L2+1)-
112)
:GOSUB 1500:RETURN
3520 IF (H>11 AND H<14) THEN DI=
10*(PEEK(L3)-112)+(PEEK(L3+1)-
11
2):RETURN
3530 IF (H>15 AND H<20) THEN SC=
(PEEK(L4)-112)+(PEEK(L4+2)-
112)/
10+(PEEK(L4+3)-112)/100:RETURN
3540 IF (H>20 AND H<24) THEN DA=
1 0 0 * ( P E E K ( L 5 ) -
112)+10*(PEEK(L5+1
)-112)+(PEEK(L5+2)-112)
3550 IF DA>359 THEN DA=DA-360:GO
TO 3550
3560 RETURN
4000 IF (R1=R1(NN)) AND (R2=R2(N
N)) AND (DI=DI(NN)) AND (SC=SC(N
N)) AND (DA=DA(NN)) THEN M1=0:GO
TO 3210
4010 M1=1:GOTO 300
```

Listing 3: SPIRO

```
00100            ORG     $6000
00110 R          RMB     1
00120 DIST       RMB     1
00130 ANGLE1     RMB     2
00140 ANGLE2     RMB     2
00150 ROTAT      RMB     2
00160 ACOUNT     RMB     2
00170 COUNT      RMB     2
00180 SCALE      RMB     1
00190 DR         RMB     5
00200 SIGN1      RMB     1
00210 NUM1       RMB     2
00220 SIGN2      RMB     1
00230 START      LDD     #0
00240            STD     ANGLE1
00250            STD     ANGLE2
00260            STD     ACOUNT
00270 XC         LDX     #STABLE
00280            CLR     SIGN1
00290            CLR     SIGN2
00300            LDD     ANGLE1
00310            ADDD    ROTAT
00320            ADDD    #90
00330 XCOMP      CMPD    #360
00340            BLO     XC1
00350            SUBD    #360
00360            BRA     XCOMP
00370 XC1        LSLB
00380            ROLA
00390            LDD     D,X
00400            BPL     CONX
00410            STA     SIGN1
00420 CONX       TFR     D,X
00430            CLRA
00440            LDB     R
00450            JSR     $9FB5
00460            STU     NUM1
00470            LDX     #STABLE
00480            LDD     ANGLE2
00490            ADDD    #90
00500            ADDD    ROTAT
00510 X2COMP     CMPD    #360
00520            BLO     XC2
00530            SUBD    #360
00540            BRA     X2COMP
00550 XC2        LSLB
00560            ROLA
00570            LDD     D,X
00580            BPL     CONX2
00590            STA     SIGN2
00600 CONX2      TFR     D,X
```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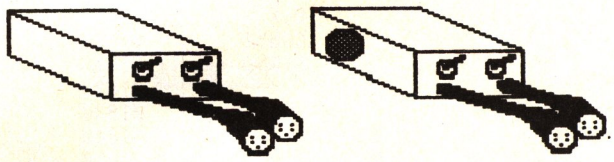

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```
00610          CLRA
00620          LDB     DIST
00630          JSR     $9FB5
00640          TFR     U,D
00650          ADDD    NUM1
00660          STD     NUM1
00670          LDA     SIGN2
00680          ADCA    SIGN1
00690          LDB     NUM1
00700          CMPD    #127
00710          LBGT    AINC
00720          CMPD    #-127
00730          LBLT    AINC
00740          STB     $BE
00750
00760 YC       LDX     #STABLE
00770          CLR     SIGN1
00780          CLR     SIGN2
00790          LDD     ANGLE2
00800          ADDD    ROTAT
00810 YCOMP    CMPD    #360
00820          BLO     YCONT
00830          SUBD    #360
00840          BRA     YCOMP
00850 YCONT    LSLB
00860          ROLA
00870          LDD     D,X
00880          BPL     CONY
00890          STA     SIGN1
00900 CONY     TFR     D,X
00910          CLRA
00920          LDB     DIST
00930          JSR     $9FB5
00940          STU     NUM1
00950          LDX     #STABLE
00960          LDD     ANGLE1
00970          ADDD    ROTAT
00980 Y2COMP   CMPD    #360
00990          BLO     Y2CONT
01000          SUBD    #360
01010          BRA     Y2COMP
01020 Y2CONT   LSLB
01030          ROLA
01040          LDD     D,X
01050          BPL     CONY2
01060          STA     SIGN2
01070 CONY2    TFR     D,X
01080          CLRA
01090          LDB     R
01100          JSR     $9FB5
01110          TFR     U,D
01120          SUBD    NUM1
01130          STD     NUM1
01140          LDA     SIGN2
01150          SBCA    SIGN1
01160          LDB     NUM1
01170          CMPD    #95
01180          BGT     AINC
01190          CMPD    #-95
01200          BLT     AINC
01210          STB     $C0
01220
01230 PSET     LDD     #$8060
01240          ADDA    $BE
01250          STA     $BE
01260          SUBB    $C0
01270          STB     $C0
01280          JSR     $9374
01290
01300 AINC     LDD     ANGLE1
01310          ADDD    #1
01320          STD     ANGLE1
01330          JSR     $B4F4
01340          LDX     #DR
01350          JSR     $BACA
01360          JSR     $B3F0
01370          STD     ANGLE2
01380
01390          LDD     ACOUNT
01400          ADDD    #1
01410          STD     ACOUNT
01420          CMPD    COUNT
01430          BHI     FIN
01440 DONE     JSR     [$A000]
01450          LBEQ    XC
01460 FIN      RTS
01470
01480 STABLE   FDB     0
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ELECTRONICS 15
COCO 3 PRINT
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BUSINESS MODEL
MASS FORMAT
*CHAMBERS

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RESUME WRITER
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SUBMAINIA
WORKBENCH
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DISK EDITOR II
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04480   FDB   -222
04490   FDB   -219
04500   FDB   -217
04510   FDB   -215
04520   FDB   -212
04530   FDB   -210
04540   FDB   -207
04550   FDB   -204
04560   FDB   -202
04570   FDB   -199
04580   FDB   -196
04590   FDB   -193
04600   FDB   -190
04610   FDB   -187
04620   FDB   -184
04630   FDB   -181
04640   FDB   -178
04650   FDB   -175
04660   FDB   -171
04670   FDB   -168
04680   FDB   -165
04690   FDB   -161
04700   FDB   -158
04710   FDB   -154
04720   FDB   -150
04730   FDB   -147
04740   FDB   -143
04750   FDB   -139
04760   FDB   -136
04770   FDB   -132
04780   FDB   -128
04790   FDB   -124
04800   FDB   -120
04810   FDB   -116
04820   FDB   -112
04830   FDB   -108
04840   FDB   -104
04850   FDB   -100
04860   FDB   -96
04870   FDB   -92
04880   FDB   -88
04890   FDB   -83
04900   FDB   -79
04910   FDB   -75
04920   FDB   -71
04930   FDB   -66
04940   FDB   -62
04950   FDB   -58
04960   FDB   -53
04970   FDB   -49
04980   FDB   -44
04990   FDB   -40
05000   FDB   -36
05010   FDB   -31
05020   FDB   -27
05030   FDB   -22
05040   FDB   -18
05050   FDB   -13
05060   FDB   -9
05070   FDB   -4
05080   END   START
```

Novices Niche

CoCo 3 Joystick

by Keiran Kenny

Joystick 3 is a simple program for colorful doodling on HSCREEN2 with the right joystick. When you run the program, press the 0 through 7 keys and you see a pixel in the corresponding color (green to orange) at the center of the screen. To change color in mid-trace, press another color key. Hold the fire button in for a flashing cursor. The program is foolproof and does not respond to keys other than 0 though 7. A diagonal trace stops when it reaches the edge of the screen and waits until you move it again with the joystick.

The Listing: JOYSTK3

```
0 'JOYSTK3' by Keiran Kenny,
   Sydney, 1988.
1 ' COPYRIGHT 1990  FALSOFT,INC
10 ONERRGOTO310
20 ONBRKGOTO320
30 POKE65497,0
40 PALETTERGB
50 HSCREEN2:HCLS8
60 EXEC44539:IFPEEK(135)>55ORPEE
K(135)<48THEN60
70 X=160:Y=96
80 J0=JOYSTK(0):J1=JOYSTK(1)
90 IFJ0<63THENX=X-1
100 IFJ0>0THENX=X+1
110 IFJ1<31THENY=Y-1
120 IFJ1>0THENY=Y+1
130 IFX<0THEN140ELSE160
140 IFJ1<31THENX=0:Y=Y+1
150 IFJ1>0THENX=0:Y=Y-1
160 IFX>319THEN170ELSE190
170 IFJ1<32THENX=319:Y=Y+1
180 IFJ1>0THENX=319:Y=Y-1
190 IFY<0THEN200ELSE220
200 IFJ0<63THENY=0:X=X+1
210 IFJ0>0THENY=0:X=X-1
220 IFY>191THEN230ELSE250
230 IFJ0<63THENY=191:X=X+1
240 IFJ0>0THENY=191:X=X-1
250 PK=PEEK(65280)
260 IFPK=126ORPK=254THENHCIRCLE(
X,Y),1,K:HCIRCLE(X,Y),1,8:GOTO30
0
270 K=PEEK(135):IFK>55ORK<48THEN
270ELSEK=K-48
280 HCOLORK:HSET(X,Y)
290 FORD=1TO100:NEXT
300 GOTO80
310 WIDTH40:LOCATE6,11:PRINT"ERR
OR #"ERNO"IN LINE #"ERLIN
320 POKE65496,0:END
```


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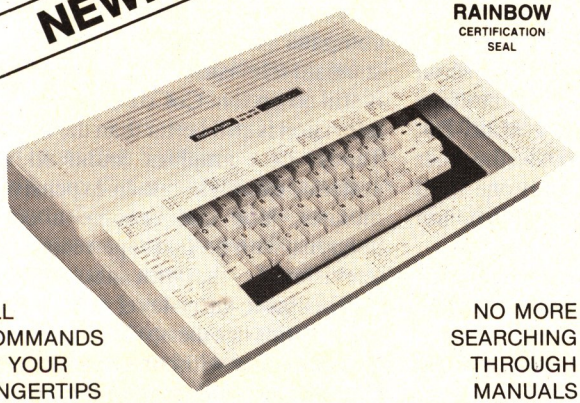

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The Future of the CoCo

by William Barden, Jr.
Contributing Editor

There's no point in denying it, MS-DOS systems such as the Tandy 1000 series and IBM PS/2 series are big business. They constitute the bulk of the computer sales all over the world. Can the CoCo survive in wake of the popularity of MS-DOS systems? Yes. Let me tell you why I think it can. First, we'll make a brief comparison of the two different systems.

Comparing Basic Capabilities

A typical MS-DOS system has 640K bytes of memory, a 720K-byte disk drive, a parallel printer port, a serial interface for data communications, and 640-by-200 CGA color graphics. This typical system costs about $1200 with a color monitor. A CoCo 3 with 512K bytes of memory, a 360K-byte disk drive, a serial interface and 640-by-192 color graphics costs about $750 with color monitor. The two systems are roughly comparable in the amount of processing they can do and speed of operation.

Both MS-DOS and the CoCo 3 allow disk drive upgrades. Hard disk drives that store 10, 20 or 40 megabytes are available for both MS-DOS systems and the CoCo for about the same price. 720K-byte disk drives are available for the CoCo at reasonable prices. Most MS-DOS systems can be upgraded to 1.44M-byte, 3½-inch floppy drives.

Graphics capabilities can be upgraded to 640-by-350 (EGA) or 640-by-480 (VGA) on MS-DOS systems. An MS-DOS EGA upgrade costs about $350 with EGA monitor; a VGA upgrade costs about $600 with VGA monitor. There is no corresponding upgrade for the CoCo to increase its graphics resolution.

There are many plug-in options available for MS-DOS systems. One of these, the 80x87 coprocessor, allows high-speed computation of floating-point numbers. This type of computation is used in number-crunching programs such as spreadsheets and speeds up computer operations in this type of program. There is no comparable upgrade for the CoCo. In addition to the coprocessor, MS-DOS systems provide plug-in boards for additional memory, scanners, clock/calendar, and control and other applications. A typical system, however, probably won't have very many of these additional boards.

The CoCo on the other hand, also has a great many plug-in options such as serial ports, digitizers and hard disk interface cards. It's true you'll need a Multi-Pak Interface for many of these, but on the other hand, CoCo options are generally one-third to one-half the cost of a comparable option on an MS-DOS system.

Software is another factor in comparing the two types of systems. There's a great deal of software for MS-DOS systems; however, the CoCo also has a large amount of reasonably priced software for basic applications — data communications, spreadsheets, word processing and the like. Again, CoCo software is much less expensive than the MS-DOS variety — about one-third to one-half the cost.

Comparing the two basic systems, the CoCo comes out with the following scoresheet:

- Computing power fairly comparable to a less expensive MS-DOS system.
- A basic price about 40 percent less.
- Upgrades in hardware at one-third to one-half the cost, but with fewer available than on MS-DOS systems.
- Software at one-third to one-half the price, but with fewer specialized software applications available.

Now, a few reasons why the CoCo is still an attractive system today.

CoCo Costs and Modularity

One of the biggest reasons the CoCo will be around for a while is its attractive entry level and upgrade prices. Where else can you get a basic computer system for about $130? It's true that adding a disk drive costs $200, but the cassette capability of the CoCo can't be found in current MS-DOS systems. Cassette storage is still a viable way to store computer data and provides a very inexpensive way to start using a computer system. As for a monitor, using a standard television as a temporary monitor is still an option. CoCo color graphics on a television is still better than the basic (non-Tandy) CGA graphics found on MS-DOS systems, even without an expensive color monitor. You can become a computer hobbyist with $130, a tape recorder and a television. Try that with an MS-DOS system!

This basic entry-level price provides a way for kids or others with limited funds to try computing without a huge investment. And the resulting system they have with that small investment is fairly powerful.

BASIC and Assembly Language Power

BASIC still remains the most popular computer language. BASIC is bundled with most computers as part of the system software. Fortunately for the computing community, BASIC used with all MS-DOS systems and with the CoCo is Microsoft BASIC. I'm not a big fan of monopolies in computer software, but in this case Microsoft BASIC has standardized BASIC programming. If you learn how to use Extended Color BASIC, you'll be able to use GW-BASIC found on MS-DOS systems with no

---

Bill Barden has written 35 books and hundreds of magazine articles about small computers . His newest Color Computer book is "Connecting the CoCo to the Real World", a book of CoCo interfacing projects. He has over 20 years experience in the industry on systems ranging from mainframes to micros.

additional training. Extended Color BASIC (and Disk BASIC) are a subset of GW-BASIC. Actually, *subset* isn't a very good word because 95 percent of the commands found in GW-BASIC are found in Extended Color BASIC with a high degree of compatibility. Extended Color BASIC is a very powerful language with the capability of doing just about anything you'd want to do on a computer system and virtually anything you can do on an MS-DOS system.

The CoCo uses a Motorola 6809 microprocessor. The assembly language used for the 6809 is a very straightforward, easy-to-use assembly language, much more so than the 80x86 assembly language used in MS-DOS systems. Motorola designed the 6809 with an instruction set that follows classic computer instructions. The 80x86 instruction set, on the other hand, is a hodge-podge of instructions that have a heritage dating back to one of the original Intel microprocessors, the 8008. Although the 80x86 instruction set is more powerful than the 6809's, it's more difficult to use. If you have any ideas about learning assembly language and want to start on a lucid instruction set, the 6809 in the CoCo probably is a better choice than the 80x86 series. Once you've learned one assembly language, you're in good shape for learning all of them.

CoCo Operating Systems

The basic CoCo operating system is really part of Disk BASIC. While the commands are not extremely powerful, they are easy to use and constitute most of the common things you need to do on a computer. The MS-DOS operating system, on the other hand, is a lot more complex, although you do get more capability.

Multitasking is the ability to run several tasks on a computer system at once. Microsoft has just brought out its new version of *Windows*, namely *Windows 3.0*, which provides this capability on high-end MS-DOS systems. Also, OS/2, a multitasking system for IBM PS/2 series computers and high-end MS-DOS compatibles, has been out for some time. CoCo OS-9, however, is a powerful multitasking operating system that's been available for the CoCo for years, at an affordable price. OS-9 is no more difficult to learn than MS-DOS, but MS-DOS can't multitask. However, once you've put in the necessary time, you have all the capabilities of a powerful operating system that can unleash the power of your CoCo.

OS-9 is very similar to the Xenix and UNIX operating systems used on larger computer systems. UNIX is highly regarded by its many users, such as those using computers like the Digital Equipment VAX series. OS-9 also allows such popular languages as C and Pascal to be used on the CoCo. A structured version of BASIC, BASIC09 can also be used under OS-9 on the CoCo and is a very powerful compiled BASIC.

CoCo Real-World Interfacing

Those of you who read this column regularly know that I am a champion of the CoCo's use in interfacing to the real world. It's possible to use the CoCo as an instrument to measure such things as windspeed, temperature and pressure. One reader, for example, uses a CoCo to measure and record precision resistances, and another uses it to control plastic cutting operations.

The reason the CoCo lends itself so well to these applications is that all versions have built-in dual joystick capability. Two joystick ports allow you to attach a variety of other devices to the CoCo and measure their inputs. MS-DOS systems also have joystick ports through a game control adapter, but it's an optional item. (For more on this, see my new book *Connecting the CoCo to the Real World.*)

The CoCo as a Game Machine

There's been a lot of negative talk among CoCo users about how the CoCo is treated by Radio Shack as a game machine. Nintendo sells about five billion dollars worth of products annually, so you really can't blame Radio Shack for wanting a share of that market. The CoCo, with its good graphics capability, *does* make an excellent game machine, albeit not quite as good as the Nintendo system with its dedicated hardware. There are many games available for the CoCo as well such as *King's Quest*, *Rampage*, *Predator*, etc. Unlike Nintendo, the CoCo not only can play a decent game of *Tetris* but does everything else a computer does, as well. For about the price of a Nintendo, you can have a system that balances your books, too.

The CoCo as a Business System

While writing this article I received a phone call from Arthur Boos of Mansfield, Texas. Arthur runs a rural water co-op not too far from the sight of the Tandy Towers in Fort Worth. The co-op has about 500 customers, and all billing is handled by four CoCos with DMP-130A and DMP-132A printers. Not only is billing handled, but accounts receivable, accounts payable, the general ledger and inventory is done as well — under OS-9. Arthur swears by the CoCos and illustrates what I've been preaching for a long time: The CoCo is a powerful system that can often be used for business applications at less cost and just as efficiently as any MS-DOS system.

Upgrading Your CoCo

If you've been considering an MS-DOS system in lieu of your current CoCo, think about some of the points I've mentioned above. I have both systems, so I'm not pushing one over the other. I do a lot of video digitizing, experimentation and data logging with my CoCos. I'll also whip out useful CoCo BASIC programs when the need arises. Much of my word processing, on the other hand, is done on my MS-DOS systems. But if I had a more limited budget, I could get along nicely with the CoCo and no MS-DOS systems and still do pretty much the same types of computing tasks that I do today.

Be realistic about the capabilities of each system. Too often we're drawn in by the hype of the computer press about new products. They are often being promoted just to generate new sales.

If you have a CoCo 1 or 2, I recommend upgrading to a CoCo 3. There's more power with better graphics and memory capability that puts the system on a par with the lower-priced MS-DOS systems. If you have a CoCo 3, consider adding some new disk drives with more capacity or possibly a hard drive.

If you're a CoCo enthusiast and haven't tried OS-9, consider giving it a shot. It's a powerful operating system that can improve the capabilities of your system dramatically if you're willing to invest some time in learning the system.

I think the CoCo is going to be around for a while. It has too much going for it, especially when it comes to cost.

See you next month with more CoCo topics.

Hard Drives for 68K

by Marty Goodman.
Contributing Editor

I have a Seagate SCSI hard drive on my CoCo 3. Can I use that with one of the soon-to-be-introduced OS-9 68K systems from Frank Hogg or Kenneth Leigh?

Jim Hutchins
Indianapolis, Indiana

Yes. The Frank Hogg and KLE systems use a SCSI bus to talk to the hard drive. The more common CoCo 3 hard drive arrangements include a SCSI drive, like the Seagate N-series, or an ST-506 drive hooked to a SCSI hard drive controller. Both work with the SCSI bus on the new OS-9/68K systems. The Burke and Burke system, however, is not compatible with a SCSI bus, so to bring the drive from that system over to the Frank Hogg or KLE system, you need to buy a SCSI controller board for the drive.

JDOS Trouble

I am having trouble using JDOS with the CoCo 3. The most recent version has pokes to make it compatible with the CoCo 3, but they also limit me to using the CoCo 3 in CoCo 2 mode. Also, I'm having problems with unreliable disk operation when using my CoCo 3 at 2MHz.

Jim Walsh
San Diego, California

Get rid of JDOS and stop beating your head against a wall. JDOS is riddled with incompatibilities and has been patched and repatched. The disk problem you are having with it or with RS-DOS is most likely due to the fact that RS-DOS and JDOS have timing constants in the disk read and write routine (DSKCON) that are too short to work with the CoCo 3 at 2MHz. To fix both problems you describe, I recommend you buy, configure and burn into an EPROM, *ADOS 3* or (if you have 512K) *Extended ADOS 3* from SpectroSystems. This modification of RS-DOS allows full use of CoCo 3 Mode and CoCo 3 BASIC commands and is by far the most compatible of all DOS mods with RS-DOS, and corrects the disk I/O software in the ROM for error-free disk I/O at 2MHz.

All Around Mess

I have a CoCo 3 whose RGB video does not work. Everything else does work. When I plug in an RGB monitor, the picture appears to lack both horizontal and vertical sync pulses. The luminance information seems to be getting through, but it is smeared and scattered all over the place. Is my GIME chip bad? Should I replace it?

Keith March (KEITHMARCH)
Continental, Ohio

Your problem could be a bad GIME chip but is probably a blown 74LS04 chip (IC15), located toward the middle of the keyboard. This chip is just in front of the keyboard cable connector and 74LS30 chip (IC14), between the LSC81001P keyboard PIA chip and the GIME chip. This 74LS04 is a hex inverter gate/buffer chip. Two of those gates (pins 9 and 10; pins 11 and 12) constitute, respectively, the inputs and outputs for buffers on the H and Vsync lines as they leave the GIME chip. Since the 74LS04 chip (and not the GIME chip) is exposed to the outside world (via the RGB port), it is more likely to get zapped (and thus protect the GIME chip from harm). Just use a logic probe or oscilloscope to examine the signals going into pins 9 and 11 and then the signals coming out of pins 10 and 12. If the signal coming out of Pin 10 is not an inverse of the one going in on Pin 9, and similarly for pins 11 and 12, then your 74LS04 has turned into a data motel (data checks in, but does not check out). The bad news is that the 74LS04 is soldered to the CoCo motherboard, so it requires the removal of the motherboard and its shield and some degree of technique to remove it without harming the CoCo 3. The good news is that this is a 25-cent chip, as opposed to the $22 price tag for a new GIME chip. *Note: Keith March later replied (via Delphi) that he replaced the 74LS04 chip with a new one, and that this completely fixed his problem. He now has a working RGB video in that computer.*

Need a Resurrection

I've got a dead 64K CoCo 2 that I'd like to repair. The screen shows only wavy black lines. I repaired one 64K CoCo 2 by replacing the 6809E chip, based on your advice in a previous column. What do you suggest I do with this dead CoCo?

James Morton Haynes
Dallas

This CoCo may be "more dead" than the last one. There are several things I'd check out: First check the power supply to make sure the +5 volts is OK. If the power supply is good, check the RF modulator (the little metal box that converts VDG video signals into RF video). It's possible the box is malfunctioning, and your TV is not getting the right frequency signal. While you are at it, make sure the channel switch is set correctly. One way to test if the problem is limited to the RF-modulator is to hook a monitor driver and video monitor up to the CoCo to see if the signal at that point is any good. Then check the memory (by chip replacement) and the SAM chip (the 74LS783 or 74LS785) and the 6809E itself. Usually

---

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

a bad memory chip or 6809E produces a flat green screen or a checkerboard of green and orange — not wavy black lines.

You might also suspect the VDG chip here (the 6847 chip). I've yet to see a dead CoCo where only the 6847 chip failed. In one CoCo that got a nasty jolt of 110 volts on its ground, every chip in it got burned out except the VDG and one small scale logic chip.

A Virus Among Us?

I'm concerned about viruses on the Color Computer. How can I tell if my disks are corrupted? What does the VERIFY ON function under Disk BASIC mean? How can I compare one disk's contents to another?

Lorin E. Owens
Bakersfield, California

I would not worry about viruses under Disk Extended Color BASIC, because it is so difficult to make one that no real virus has, to my knowledge, ever been created for it. This is because the operating system is burned into firmware in the ROMs of the computer, and so is, in effect, impossible to corrupt. One can in theory create a virus that perpetuates itself from disk to disk even under Disk Extended BASIC (several of us on Delphi have discussed how this could be done), but to my knowledge it has never been done. If it did occur, it would be easy to spot and fix, because disks with this sort of virus do not duplicate properly with the BACKUP command if that command is used immediately after a power-up of the computer system.

Under OS-9, much more sophisticated viruses are possible, but OS-9 users tend to be a responsible crowd, and I don't know of any problems with OS-9 viruses to date.

VERIFY ON simply means the computer checks to see that it has correctly written a sector during writes. This check takes extra time, but ensures that the data is being written properly. The best way to compare two disks is with a machine language compare program. However, a relatively effective one can be written under BASIC:

```
10 FOR T=0 TO 34
20 FOR S=1 TO 18
30 DSKI$ 0,T,S,A$,B$
40 DSKI$ 1,T,S,C$,D$
50 IF A$<>C$ THEN GOTO 100
60 IF B$<>D$ THEN GOTO 100
70 NEXT S
80 NEXT T
90 PRINT "DISKS ARE IDENTICAL":E
ND
100 PRINT "DISKS ARE DIFFERENT I
N:"
110 PRINT "TRACK ";T
120 PRINT "SECTOR ";S
130 END
```

This program compares all 35-tracks on a disk in Drive 0 with those on a disk in Drive 1. If it finds a discrepancy, it notes what track and sector it is in. For a 40-track disk, change FOR T=0 TO 34 to FOR T=0 TO 39. For an 80-track disk, change FOR T=0 TO 34 to FOR T=0 TO 79.

The Hi-Res Joystick Interface

I recently purchased a Hi-Res Joystick Interface for the Color Computer 3, but I cannot get it to work with the JOYSTK commands from BASIC. Can you help?

Steve Buehler
Santa Ana, California

The Hi-Res Joystick Interface requires special software. THE RAINBOW published a three-part series (July 1986 through September 1986) by Steve Bjork, inventor of the Hi-Res interface. These articles include a discussion of how the interface works, as well as assembly language routines for accessing it. Alternatively, the adapter can be used with *CoCo Max 3* and *Max 10*.

Also refer to "Programming for the Hi-Res Joystick Interface," by Duane Perkins (February 1988, Page 122) and "Barden's Buffer" (February 1990, Page 42) for further information on using the Hi-Res Joystick Interface.

FAX Chance?

Is there any way to send and receive FAX messages using a Color Computer?

Marvin E. Logan
Ft. Carson, Colorado

If, by FAX, you mean the 4800 or 9600 baud CCITT Group III type FAX commonly used now by businesses, the answer is no. To allow a computer to send or receive that highly sophisticated FAX protocol, dedicated hardware cards are needed. Too few people with Color Computers have an interest in buying such hardware, so none has ever been developed for the CoCo. In my article, "Weather . . . or Not?" (February 1985, Page 42), I presented in a program that allows a Color Computer (any model) to receive Weather FAX transmissions broadcast on shortwave radio. These use an ancient, vastly simpler protocol. For those interested, there is an update to that program available from me that lets you use other printers and send and receive WEFAX signals.

Disk Drive Housing

Can I use the case and power supply that once housed a single, MPI 52A, full-height disk drive to house and power one 5¼-inch half-height drive and one 3½-inch half-height drive?

Joseph D. Meaux, Jr.
Lafayette, Louisiana

Probably. As I noted in my two-part article on disk drives in THE RAINBOW, older full-height drives tend to use significantly more power than modern half- and third-height drives. It is likely that the supply you have will power both newer drives.

You need to add another power connector and check that the supply is not being overloaded. To check for overload, see if the regulator chips are running hot.

Another thing you can do is check the input voltage to the regulator chips. If the input voltage to the 5-volt regulator does not drop below 8 volts when the drives are being accessed, and if the input voltage to the 12-volt regulator does not drop below 15 volts, you have further evidence that the power supply will handle the load.

Your technical questions are welcomed. Please address them to CoCo Consultations, THE RAINBOW, P. O. Box 385, Prospect, KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Questions can also be sent to Marty through the Delphi CoCo SIG. From the CoCo SIG> prompt, pick Rainbow Magazine Services. Then at the RAINBOW> prompt, type ASK (for Ask the Experts) to arrive at the EXPERTS> prompt, where you can select the "CoCo Consultations" online form, which has complete instructions.

ife Without ine Numbers

Will the virtues of BASIC09 never cease?

by Dean Bergmann

Since I have begun to learn a little about BASIC09, I have come to the startling conclusion that BASIC09 is easier to use than Color BASIC, Extended Color BASIC or Disk BASIC (once you have learned to use OS-9). When programming in BASIC09, it is easier to keep track of your own variables and program flow; it's easier to follow the logic and program flow of someone else's listing; it's easier to debug; and its structure makes program listings clearer.

I put off learning BASIC09 for a long time. I'd *seen* statements that programming without line numbers was great. Though I didn't doubt it was possible, I just couldn't see how that would work — there were all those listings! How could you follow program logic without line numbers? As in most instances of switching from one system to another, my previous learning was getting in the way. I was trying to make it more complicated than was really necessary.

I can't give a complete tutorial here in one easy lesson, but I will try to make it easier for you to look at other BASIC09 listings you've seen printed in THE RAINBOW. In order to explain to someone who doesn't yet own a copy of BASIC09, it's necessary to have a simple, clear program listing. We want a program that illustrates general principles, so we'll just print names on the screen. In BASIC09, all programs are called *procedures*. We'll call this procedure, shown in Listing 1, `PrintName`.

For now, ignore the hexadecimal numbers on the left. You never type those in, and if you change a single space in the program, they'll end up different anyway. These hexadecimal numbers are called *offsets* and are useful for pointing out locations in your program and for finding bugs when you get an error message. As you type in the listing, you don't have to capitalize the commands because BASIC09 takes care of that for you.

One of the first lessons to learn in BASIC09 is that the programmer has to define variables. This may seem more complex at first glance, but it actually helps to make things simpler. Defining a variable automatically clears space for it. As a result, there are no `CLEAR` or `PCLEAR` commands; no guessing about how much memory you'll need to run the program.

Now we have to decide what we'll call these variables. Because there isn't a two-letter limit, BASIC09 is very forgiving with variable names. You can choose to use the dollar sign ($) for string variables, or you can elect not to — the choice is up to you.

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It's a trade-off between how many letters you want to type, what is easier for you to remember while you are programming, and how readable you want your listing. Remember, you may need to read your own program listing six months or a year down the road, so as long as they're not terribly long, I always opt for readability.

We define variables using the DIM statement. Because just about anyone's name can fit into 35 characters, we'll define the name variables in Listing 1 as 35-character string variables. After defining these variables, we assign values to them. If you would like to keep up the nice practices you were taught in programming class, you can use := instead of =, but this is not really important to how the program runs.

Next we'll print each name on the screen, starting 20 spaces over from the left side, with a blank line between each one. Isn't that simple? Now, look at the listing again. The procedure flows from one line to the next — with no line numbers — from beginning to end. Of course that's obvious in a listing this simple, but how about programs that have a lot of options and require subroutines and choices? Let's add some to our program (see Listing 2).

First we have to add a couple of new variables. We'll use a string variable (choice) with inkey and an integer (count) in the FOR/NEXT loop. Next we'll list the choices on the screen and start polling the keyboard. In BASIC09, inkey is not a regular command but a separate procedure, so we have to run the program and pass the value it gives back to our own procedure (i.e., passing parameters). Otherwise it works in the same way that it does in other forms of BASIC — it looks at the keyboard one time, and if it does not find a key pressed, it releases control to the next line in the program. With other forms of BASIC, this means using a GOTO in order to keep repeating the line until a key is pressed. Since we have chosen not to use line numbers here, let's try REPEAT/UNTIL. At this point the program keeps polling the keyboard until the ASCII value of the key pressed is right for one of the choices.

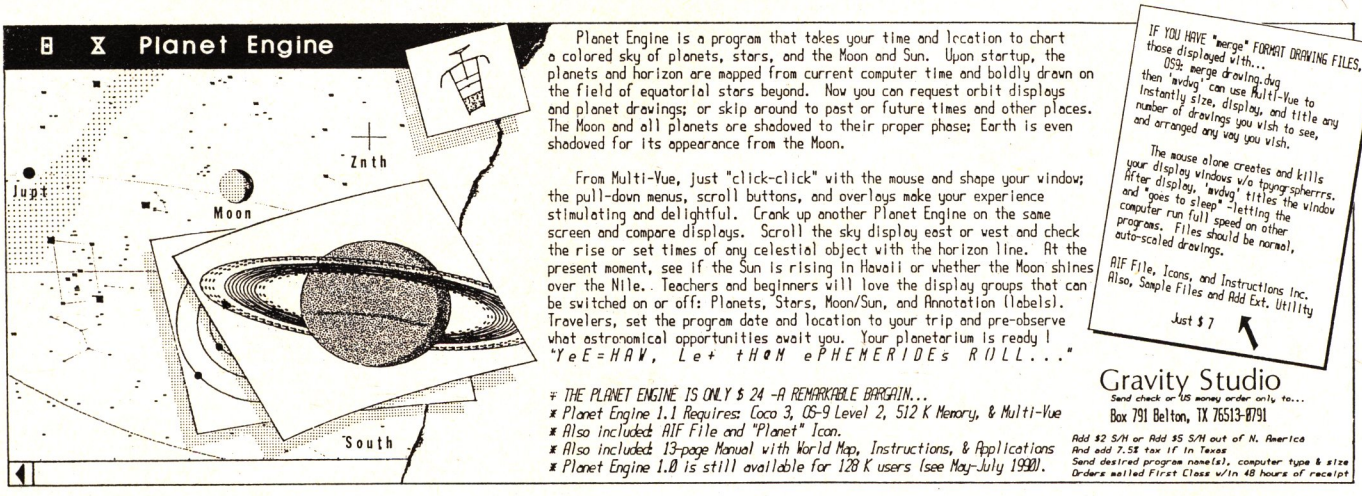
Notice that everything between REPEAT and UNTIL is indented. BASIC09 automatically indents statements in your program that appear inside a control structure. For instance, look at the IF/ENDIFs further down in the listing. In each one, when the IF statement is not true, the program simply skips to the corresponding ENDIF and continues from there. Notice how the indentations make the REPEAT, FOR and IF lines stand out from the rest (making them more visible).

It might have been simpler in this listing to have used ON GOSUB 1000, 2000, 3000, 4000 with corresponding line numbers (BASIC09 allows that), but consider how many GOTOs and GOSUBs are used in most BASIC listings. In order to follow a program's logic, which is necessary during debugging, you have to keep jumping back and forth all through a listing. Finding a bug or altering a program can be like wandering through a maze, especially if you're typing or trying to understand a listing created by someone else. Avoiding this maze is what's really nice about not using line numbers. (Of course, BASIC09 let's you use line numbers if you really want to.)

OS-9

Listing 1: PrintName

```
PROCEDURE PrintName
 0000       DIM yourname,hisname,hername:STRING[35]
 0014       yourname=""
 001B       hisname=""
 0022       hername=""
 0029
 002A       INPUT "Enter Your Name: ",yourname
 0043       INPUT "Enter His Name: ",hisname
 005B       INPUT "Enter Her Name: ",hername
 0073
 0074       PRINT  \ PRINT  \ PRINT
 007A       PRINT TAB(20); yourname
 0083       PRINT
 0085       PRINT TAB(20); hisname
 008E       PRINT
 0090       PRINT TAB(20); hername
 0099       END
```

Planet Engine is a program that takes your time and location to chart a colored sky of planets, stars, and the Moon and Sun. Upon startup, the planets and horizon are mapped from current computer time and boldly drawn on the field of equatorial stars beyond. Now you can request orbit displays and planet drawings; or skip around to past or future times and other places. The Moon and all planets are shadowed to their proper phase; Earth is even shadowed for its appearance from the Moon.

From Multi-Vue, just "click-click" with the mouse and shape your window; the pull-down menus, scroll buttons, and overlays make your experience stimulating and delightful. Crank up another Planet Engine on the same screen and compare displays. Scroll the sky display east or west and check the rise or set times of any celestial object with the horizon line. At the present moment, see if the Sun is rising in Hawaii or whether the Moon shines over the Nile. Teachers and beginners will love the display groups that can be switched on or off: Planets, Stars, Moon/Sun, and Annotation (labels). Travelers, set the program date and location to your trip and pre-observe what astronomical opportunities await you. Your planetarium is ready! *"YeE=HAV, Let tHeM ePHEMERIDEs ROLL..."*

IF YOU HAVE "merge" FORMAT DRAWING FILES, those displayed with... OS9: merge drawing.dwg then 'mvdvg' can use Multi-Vue to Instantly size, display, and title any number of drawings you wish to see, and arranged any way you wish.

The mouse alone creates and kills your display windows w/o tpyng=spherrrs. After display, 'mvdvg' titles the window and "goes to sleep" -letting the computer run full speed on other programs. Files should be normal, auto-scaled drawings.

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* Also included: 13-page Manual with World Map, Instructions, & Applications
* Planet Engine 1.0 is still available for 128 K users (see May-July 1990).

The second choice, the FOR/NEXT loop, prints the name 10 times. The third choice keeps listing it until you press the BREAK key, unless of course her name really is Brutus, which will break the loop.

The fourth choice runs another procedure (Listing 3) that gets its variables and their values (parameters) from the main program. If this new procedure — used like a subroutine — altered the values of those variables, the new values are passed back to the main program. The PARAM statement takes care of passing the variables in both directions.

In many BASIC09 listings you'll see TYPE statements. For brevity, I'm leaving them out of these listings. When a procedure uses a lot of different variables that need to be passed around to a disk, a printer or another procedure, it is often easier to combine them into one complex variable. TYPE statements define complex variables.

BASIC09 always checks for errors when you enter each line, which is nice because it catches a lot of them. Then, every time you go from the Edit mode to the Command mode, it checks your whole listing for errors. Errors caught at this time are mostly missing control structures: LOOP without ENDLOOP, FOR without NEXT, IF without ENDIF and so on. By the time you have finished your first draft, a lot of your debugging will be done.

Disk Extended Color BASIC is not a true disk operating system (DOS). In fact it has barely enough disk functions to make your drives usable. If you have never used another DOS, then learning OS-9 requires about as much time and effort as learning Extended Color BASIC. I first tried OS-9 with 128K and one disk drive, but I quickly found out that 512K and two drives were necessary to avoid a lot of frustration. But then, even with Disk BASIC, two drives put an end to a lot of disk swapping.

Once you have learned your way around the operating system, BASIC09 has its own rewards to add to OS-9. For instance, it has enough in common with other BASICs that you won't have to start from scratch to learn your way around. I hope this makes the listings you see easier to understand.

If you decide to give OS-9 a try, you'll find that its multitasking abilities open up a whole new world. Many compare it to switching from cassette tapes to disks. Imagine never having to quit the program you're using in order to look up that file name you forgot, or to see how much disk space is left, or even to format a disk. You can take a break from your word processor to play a game for a while and then go back to your document right where you left the cursor. The time spent learning OS-9 is well-rewarded. ❑

Listing 2: PrintName1

```
PROCEDURE PrintName1
 0000       DIM yourname,hisname,hername:STRING[35]
 0014       DIM choice:STRING[1]
 0020       DIM count:INTEGER
 0027
 0028       yourname=""
 002F       hisname=""
 0036       hername=""
 003D
 003E       INPUT "Enter Your Name: ",yourname
 0057       INPUT "Enter His Name: ",hisname
 006F       INPUT "Enter Her Name: ",hername
 0087
 0088       PRINT  \ PRINT  \ PRINT
 008E       PRINT TAB(20); "SCREEN PRINTING OPTIONS"
 00AD       PRINT
 00AF       PRINT TAB(24); "1.  Your Name"
 00C4       PRINT TAB(24); "2.  His Name"
 00D8       PRINT TAB(24); "3.  Her Name"
 00EC       PRINT TAB(24); "4.  All the Names"
 0105       PRINT
 0107       PRINT TAB(22); "[Press 1, 2, or 3]"
 0121
 0122       REPEAT
 0124         choice=""
 012B         RUN inkey(choice)
 0135       UNTIL ASC(choice)>48 AND ASC(choice)<53
 0149
 014A       PRINT  \ PRINT  \ PRINT
 0150
 0151       IF choice="1" THEN
 015E         PRINT TAB(20); yourname
 0167       ENDIF
 0169
 016A       IF choice="2" THEN
 0177         IF hisname="Sue" THEN
 0186           PRINT TAB(20); "Wasn't there a song about him?"
 01AC         ENDIF
 01AE         FOR count=1 TO 10
 01BE           PRINT TAB(20); hisname
 01C7         NEXT count
 01D2       ENDIF
 01D4
 01D5       IF choice="3" THEN
 01E2         LOOP
 01E4           PRINT hername,
 01EA         EXITIF hername="Brutus" THEN ENDEXIT
 01FF         ENDLOOP
 0203       ENDIF
 0205
 0206       IF choice="4" THEN
 0213         RUN print_all_the_names(yourname,hisname,hername)
 0227       ENDIF
 0229
 022A       PRINT  \ PRINT
 022E       END
```

Listing 3: PrintName2

```
PROCEDURE PrintName2
 0000       PARAM yourname,hisname,hername:STRING[35]
 0014       PRINT  \ PRINT  \ PRINT
 001A       PRINT TAB(20); yourname
 0023       PRINT
 0025       PRINT TAB(20); hisname
 002E       PRINT
 0030       PRINT TAB(20); hername
 0039       END
```

Elementary, my dear Watson

Who Dunnit?

by Rob Becker

Simulating *Clue*, the popular board game, *Detecto* allows you to play a detective who must solve the murder that has taken place at the Falsoft Building. There are six suspects, six weapons and nine rooms. You must find out who did it, what weapon was used and what room it happened in. You have 50 turns to solve the murder, and you must try to get clues to help you.

Detecto was written on a 32K disk system but should run on a 16K system if you do a PCLEAR1 before loading the program.

You move around the building using the directions north, south, east and west. There are six weapons in the house. The weapon used by the murderer is hidden. To find the other weapons, you must search each room. If you find a weapon, you know that weapon was not used by the murderer. Occasionally you do not find a weapon in the room even though it is there. Sometimes you must search more than once.

Often, when you search a room, you find a tip. A tip tells you one of three things: who committed the murder, what weapon was used or what room the murder occurred in. You may choose one of these three questions to ask the computer, but you do not always get the truth. Sometimes the computer throws you off track. To keep from getting thrown off track, you must ask many questions. More often than not, however, you get the truth. There are three kinds of tips. They are: free tip, 5-turn tip and 10-turn tip. On the 5-turn tip and the 10-turn tip you are asked if you want the tip. If you say Yes, you lose the amount of turns the tip is worth. If you say No, you do not lose a turn.

As in a real murder investigation, you can question the suspects. And, like a real investigation, you do not always get the truth. You may ask the suspects one of three things: who did it, what weapon or what room. You will notice the truth is told more often than not, and the more questions you ask, the easier it is to solve the murder.

Sometimes the suspect refuses to answer a question. If this is so, you cannot ask the suspect a question until you leave the room and come back at another time. You can only ask the suspect one question during the game.

To keep track of what you've found or the information you have received from suspects, you have a list. The list has all the suspects' names on it, all the weapons and all the rooms of the building (except for the parking lot, because a murder is never committed there).

To see the list, press L while the game is in progress. You do not lose a turn when you look at your list. An asterisk or a number next to a suspect, weapon or room means that it has been suspected as being part of the murder. The number of asterisks shown tells the number of times it has been suspected. A greater than sign (>) next to a weapon means that you have found that weapon.

While you are looking at your list, you are asked if you want to solve the murder. Answer Yes or No. If you answer No, you return to the game; otherwise, type in the suspect, the weapon and the room.

After you have typed in your suspect, weapon and room, the computer suspensefully tells you if you've won or lost. Also at the end of the game, you receive a score.

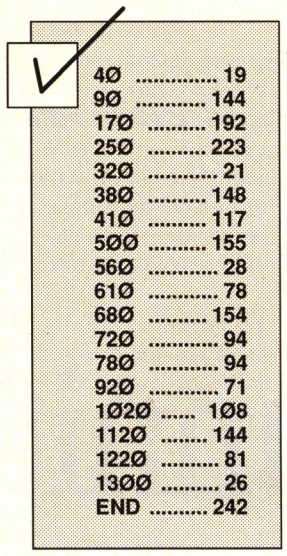
Scoring	
Each turn	10 pts.
Weapons found	50 pts.
Correct killer suspect	400 pts.
Correct weapon	300 pts.
Correct murder room	500 pts.
Solving the murder	600 pts.
Best possible score	2460 pts.

You get 10 points for every turn you have left. The best possible score is almost impossible to get. You get 50 points for every weapon you find.

You get 600 points extra if you solve the murder along with the points for the correct killer, weapon and room. Once you receive your score, you also see the murderer, the weapon used to commit the murder, and the room the murder took place in. After every move you make, press any key to continue the game.

Over 2000 points is a good score. My high score is 2380 points. It is good to search all the rooms to find all the weapons, because you will know which weapon is hidden, and you will also get 250 points extra. Question all the suspects, so you get all the information possible. Once you think you can solve the murder, do so. Good luck! ❑

Robert Becker studies economics and business management at Cornell University. His hobbies include music (he is also a disc jockey) and computers.



```
40 ..... 19
90 ..... 144
170 ..... 192
250 ..... 223
320 ..... 21
380 ..... 148
410 ..... 117
500 ..... 155
560 ..... 28
610 ..... 78
680 ..... 154
720 ..... 94
780 ..... 94
920 ..... 71
1020 ..... 108
1120 ..... 144
1220 ..... 81
1300 ..... 26
END ..... 242
```

The Listing: DETECTO

```
0 ' COPYRIGHT 1990 FALSOFT, INC
1 '       *** DETECTO ***
2 '    *** BY ROB BECKER ***
3 ' *** COPYRIGHT (C) 1990 ***
10 CLS(C):PRINT@40,"*** DETECTO
***";:PRINT@69,"*** BY ROB BECKE
R ***";:PRINT@99,"*** COPYRIGHT
(C) 1990 ***";:FORX=1TO800:NEXT:
IFDI=1 THENGOSUB60:DI=0:GOTO1250
20 X=RND(-TIMER):FORZ=1TO10:X=RN
D(63):Y=RND(20)+11:SET(X,Y,5):PL
AY"V31O1T20C":NEXT
30 FORX=1TO300:NEXT:PRINT@266,"W
HO DUN IT?";
40 FORX=1TO2000:NEXT:DI=1:C=1:GO
TO10
50 RM=RND(10):TL=51:SC=51
60 SU$(1)="LONNIE FALK":SU$(2)="
CRAY AUGSBURG":SU$(3)="TONY OLIV
E":SU$(4)="GREG LAW":SU$(5)="KEL
LY GOFF":SU$(6)="HEIDI NELSON"
70 WP$(1)="COCO":WP$(2)="CASSETT
E":WP$(3)="DISK DRIVE":WP$(4)="M
ULTI-PAK":WP$(5)="PRINTER":WP$(6
)="MODEM"
80 RM$(1)="COMPUTER ROOM":RM$(2)
="LOBBY":RM$(3)="OFFICE":RM$(4)=
"HALLWAY":RM$(5)="CONF.ROOM":RM$
(6)="KITCHEN":RM$(7)="STAIRWAY":
RM$(8)="BASEMENT":RM$(9)="ELEVAT
OR":RM$(10)="PARKING LOT"
90 IFDI=1THEN RETURN
100 FORX=1TO6
110 RP(X)=RND(9):FORY=1TO6:IFY=X
 THENNEXTY ELSEIFRP(X)=RP(Y) THE
N110ELSENEXTY
120 NEXTX
130 FORX=1TO6
140 RW(X)=RND(9):FORY=1TO6:IFY=X
 THENNEXTY ELSEIFRW(X)=RW(Y) THE
N140 ELSENEXTY
150 NEXTX
160 KS=RND(6):KS$(KS)=SU$(KS):KW
=RND(6):KW$(KW)=WP$(KW):KR=RND(6
):KR$(KR)=RM$(KR):RW(KW)=0
170 TL=TL-1:IFTL=0 THEN1130 ELSE
SC=TL+SW:CLS:SOUND200,1:PRINT@37
,"ROOM : ";RM$(RM)
180 PRINT@62,"I";:PRINT@94,"I";:
PRINT@126,"S";:PRINT@158,"T";
190 PRINT@101,"TURNS LEFT :";TL;
200 PRINT@165,"YOU SEE : ";:IFSU
$(RM)="" THEN PRINT"NOBODY" ELSE
PRINTSU$(RM)
210 GOSUB810:PRINT@262,"*";
220 IFD(1)=1 THENPRINT@230,"N";
ELSEPRINT@230,"-";
230 IFD(2)=1 THENPRINT@263,"E";
ELSEPRINT@263,"-";
240 IFD(3)=1 THENPRINT@294,"S";
ELSEPRINT@294,"-";
250 IFD(4)=1 THENPRINT@261,"W";
ELSEPRINT@261,"-";
260 IFRP(RM)>0 AND QQ(RM)=0 OR Q
Q(RM)=2 THENPRINT@268,"qUESTION"
;
270 PRINT@332,"sEARCH";:PRINT@39
6,"mOVE";
280 A$=INKEY$:IFA$="M" THEN 290
```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```
ELSEIFA$="S"THEN330ELSEIFA$="Q"T
HEN390ELSEIFA$="L"THEN560ELSE280
290 SOUND100,1:IFQQ(RM)=2 THEN Q
Q(RM)=0
300 PRINT@396,"direction?"
310 D$=INKEY$:IFD$="N" OR D$="S"
 OR D$="E" OR D$="W" THEN320ELSE
310
320 GOSUB920:SOUND1,10:GOTO300
330 PRINT@332,"search";:FORY=1TO
350:NEXT:FORX=1TO5:PRINT".";:SOU
ND100,1:FORY=1TO350:NEXTY:NEXTX
340 IFRND(5)=1 AND TL>10 THEN730
350 IFRW(RM)=0 THEN 360 ELSEIFRN
D(5)=1 THEN360 ELSEIFWF(RM)=1THE
N360 ELSE370
360 PRINT@332,"NOTHING FOUND.":S
OUND1,10:GOSUB1340:GOTO170
370 FORX=1TO2:PRINT@332,"SEARCH"
;:FORY=1TO200:NEXTY:PRINT@332,"s
earch";:SOUND200,1:FORY=1TO200:N
EXTY:NEXTX
380 FORX=1TO350:NEXT:PRINT@332,W
P$(RM);".":WF(RM)=1:SW=SW+5:GOSU
B1340:GOTO170
390 IFRP(RM)=0 OR QQ(RM)=1 OR QQ
(RM)=2 THEN 280ELSEIFRND(4)=1 TH
ENPRINT@268,"SUSPECT REFUSES.":S
OUND1,5:FORX=1TO200:NEXT:SOUND1,
5:GOSUB1340:IFQQ(RM)=0 THEN QQ(R
M)=2:GOTO170 ELSE 170
400 QQ(RM)=1:PRINT@268,"SUSPECT
QUESTIONED.":SOUND200,1:PRINT@30
0,"ASK : ";SU$(RM):PRINT@332,"1)
 WHO DID IT?":PRINT@364,"2) WHAT
 WEAPON?":PRINT@396,"3) WHAT ROO
M?":PRINT@428,"QUESTION";:INPUTQ
:IFQ<1 OR Q>3 THEN400
410 PRINT@428,"***************";
:PRINT@460,"*";:PRINT@474,"*";:P
RINT@492,"***************";:PRIN
T@461,"";:FORY=1TO250:NEXTY:FORX
=1TO13:PRINT".";:SOUND200,1:FORY
=1TO250:NEXTY:NEXTX
420 ON Q GOTO 430,480,520
430 IFKS=RM THEN 440 ELSE460
440 BL=RND(6):IFBL=KS OR BL=RM T
HEN440
450 SS(BL)=SS(BL)+1:PRINT@461,SU
$(BL):PRINT@474,"*";:SOUND150,1:
GOSUB1340:GOTO170
460 IFRND(3)=1THEN440
470 SS(KS)=SS(KS)+1:PRINT@461,SU
$(KS):PRINT@474,"*";:SOUND150,1:
GOSUB1340:GOTO170
480 IFRND(2)=1 THEN490 ELSE510
490 BL=RND(6):IFBL=KW THEN 490
500 WS(BL)=WS(BL)+1:PRINT@461,WP
$(BL):PRINT@474,"*";:SOUND150,1:
GOSUB1340:GOTO170
510 WS(KW)=WS(KW)+1:PRINT@461,WP
$(KW):PRINT@474,"*";:SOUND150,1:
GOSUB1340:GOTO170
520 IFRND(3)=1 THEN530 ELSE550
530 BL=RND(9):IFBL=KR THEN530
540 RS(BL)=RS(BL)+1:PRINT@461,RM
$(BL):PRINT@474,"*";:SOUND150,1:
GOSUB1340:GOTO170
550 RS(KR)=RS(KR)+1:PRINT@461,RM
$(KR):PRINT@474,"*";:SOUND150,1:
GOSUB1340:GOTO170
560 TL=TL+1:CLS:PRINT@0,"suspect
s":FORX=1TO6:PRINT@0+(32*X),SU$(
X);" ";:IFSS(X)=0 THEN NEXTX ELS
EFORY=1TO SS(X):PRINT"*";:NEXTY:
NEXTX
570 PRINT@225,"weapons":FORX=1TO
6:PRINT@224+(32*X),"";:IFWF(X)=1
 THENPRINT">"; ELSEPRINT" ";
580 PRINTWP$(X);" ";:IFWS(X)=0 T
HEN NEXTX ELSEFORY=1TO WS(X):PRI
NT"*";:NEXTY:NEXTX
590 PRINT@17,"rooms":FORX=1TO9:P
RINT@17+(32*X),RM$(X);:IFRS(X)=0
 THENNEXTX ELSEIFRS(5)>0 THENPRI
NTRS(5);"M"; ELSEPRINTRS(X);:NEX
TX
600 PRINT@369,"SOLVE(Y/N)";:INPU
TS$:IFS$="Y" THEN610 ELSE170
610 SC=TL+SW:CLS:PRINT@1,"suspec
ts":FORX=1TO6:PRINT@0+(32*X),X;"
) ";SU$(X)" ";:IFSS(X)=0 THEN NE
XTX ELSEFORY=1TO SS(X):PRINT"*";
:NEXTY:NEXTX
620 PRINT@257,"SUSPECT";:INPUTYS
630 CLS:PRINT@1,"weapons":FORX=1
```


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```
TO6:PRINT@Ø+(32*X),X;") ";:IFWF(
X)>Ø THENPRINT">"; ELSEPRINT" ";
64Ø PRINTWP$(X);" ";:IFWS(X)=Ø T
HENNEXTX  ELSEFORY=1TO WS(X):PRI
NT"*";:NEXTY:NEXTX
65Ø PRINT@257,"WEAPON";:INPUTYW
66Ø CLS:PRINT@1,"rooms":FORX=1TO
9:PRINT@Ø+(32*X),X;") ";RM$(X);"
 ";:IFRS(X)=Ø THENNEXTX ELSEFORY
=1TO RS(X):PRINT"*";:NEXTY:NEXTX
67Ø PRINT@353,"ROOM";:INPUTYR
68Ø FORX=1TO1Ø:C=RND(8):CLS(C):S
OUNDC*3,1:FORY=1TO5Ø:NEXTY:NEXTX
:CLSØ:FORX=1TO2ØØØ:NEXT
69Ø CLS:IFYS<>KS THEN 114ØELSEPR
INT@172,"SUSPECT":A=32-LEN(SU$(K
S)):A=A/2:PRINT@256+A,SU$(KS):SO
UND5Ø,2Ø:FORX=1TO5ØØ:NEXT:CLSØ:F
ORX=1TO15ØØ:NEXT
7ØØ CLS:IFYW<>KW THEN 114ØELSEPR
INT@173,"WEAPON":A=32-LEN(WP$(KW
)):A=A/2:PRINT@256+A,WP$(KW):SOU
ND1ØØ,2Ø:FORX=1TO5ØØ:NEXT:CLSØ:F
ORX=1TO15ØØ:NEXT
71Ø CLS:IFYR<>KR THEN 114ØELSEPR
INT@174,"ROOM":A=32-LEN(RM$(KR))
:A=A/2:PRINT@256+A,RM$(KR):SOUND
15Ø,2Ø:FORX=1TO5ØØ:NEXT:CLSØ:FOR
X=1TO15ØØ:NEXT
72Ø SC=SC+6Ø:WI=1:GOTO114Ø
73Ø X=RND(3)
74Ø ON X GOTO 75Ø,76Ø,77Ø
75Ø TL=TL+1:PRINT@332,"FREE TIP"
:SOUND255,5:GOTO78Ø
76Ø PRINT@332,"TIP - 5 TURNS";:S
OUND25Ø,5:INPUTT$:IFT$="N" THEN
TL=TL+1:GOTO17Ø ELSEIFT$="Y" THE
N TL=TL-4:GOTO78Ø ELSE76Ø
77Ø PRINT@332,"TIP - 1Ø TURNS";:
SOUND24Ø,5:INPUTT$:IFT$="N" THEN
 TL=TL+1:GOTO17Ø ELSEIFT$="Y" TH
EN TL=TL-9:GOTO78Ø ELSE77Ø
```

Utility 64K

Novices Niche

Line Copy
An Easy Way to Copy Program Lines

by Geoff Friesen

Entering long program listings into the CoCo by hand can become very tedious. I created *Line Copy* to ease this pain. *Line Copy* makes a copy of any line in a program. As an example, suppose you wanted to copy Line 100 in the following program to Line 400.

```
100 PRINT HEX$ (PEEK(&H8C1B)*256
+PEEK(&H8C1C))
```

You would type `LCOPY 100 TO 400`, which results in the following program:

```
100 PRINT HEX$ (PEEK(&H8C1B)*256
+PEEK(&H8C1C))
400 PRINT HEX$ (PEEK(&H8C1B)*256
+PEEK(&H8C1C))
```

Needless to say, *Line Copy* can save a great deal of typing — and Syntax errors.

The syntax of *Line Copy* is:

`LCOPY` *sourceline* `TO` *destline*

sourceline, `TO` and *destline* are necessary. If any of these are missing or one of the numbers is out of range, a Syntax Error occurs. If *sourceline* does not exist, *Line Copy* generates an Undefined Line Error. It does not matter if *destline* exists, because it is replaced with *sourceline*.

Line Copy is most useful in conjunction with `EDIT`. Some programs have many similar lines. After the first such line is entered, *Line Copy* can be used to copy this line to the appropriate places. Minor changes to the new lines can then be made with the `EDIT` command.

Unfortunately, once *Line Copy* is installed, `SKIPF` is no longer available. This is a tradeoff I had to make. Originally I wanted to get rid of `DLOAD` because `DLOAD` has no useful purpose; however, it is rather tricky to remove `DLOAD` and I wanted this program to run under Extended BASIC as well as Disk BASIC. In the future I will replace `DLOAD` with `LCOPY` and leave `SKIPF` alone. A future version of *Line Copy* will support a range of lines where *sourceline* appears, making `LCOPY` even more useful.

If you are using a 64K CoCo 1 or 2, you must put it into the all-RAM mode before running `LCOPY`. Refer to Listing 3 in the April 1990 issue (Page 109) for `ALLRAM`. Since the CoCo 3 is always in the all-RAM mode, no modifications are needed.

The Listing: `LCOPY`

```
Ø ' COPYRIGHT 1990  FALSOFT,INC
1ØØ REM ——-
11Ø REM LCOPY
12Ø REM ——-
13Ø CLEAR 2ØØ,PEEK(&H27)*256+PEE
K(&H28)-85
14Ø SA=PEEK(&H27)*256
15Ø SA=SA+PEEK(&H28)+1
16Ø FOR I=SA TO SA+85
17Ø READ B$: POKE I,VAL("&H"+B$)
18Ø NEXT I
19Ø DATA 24,4C,BD,AF,67,9E,2B,AF
2ØØ DATA 8D,ØØ,3F,9D,A5,81,A5,26
21Ø DATA 3D,9D,9F,24,39,BD,AF,67
22Ø DATA 9E,2B,AF,8D,ØØ,2E,9D,A5
23Ø DATA 26,2C,AE,8C,25,9F,2B,BD
24Ø DATA AD,Ø1,25,25,DE,47,33,44
25Ø DATA 8E,Ø2,DC,C6,Ø4,37,Ø2,A7
26Ø DATA 8Ø,5C,4D,26,F8,AE,8C,ØC
27Ø DATA BF,Ø2,DA,9F,2B,32,62,7E
28Ø DATA AC,BØ,ØØ,ØØ,ØØ,ØØ,7E,B2
29Ø DATA 77,C6,ØE,7E,AC,46
3ØØ FOR I=&HAAF1 TO &HAAF5
31Ø READ B$
32Ø POKE I,VAL("&H"+B$)
33Ø NEXT I
34Ø DATA 4C,43,4F,5Ø,D9
35Ø POKE &HABAD,SA/256
36Ø POKE &HABAE,SA AND 255
```

```
780 PRINT@364,"1) SUSPECT":PRINT
@396,"2) WEAPON":PRINT@428,"3) R
OOM":PRINT@460,"WHICH ONE";:INPU
TQ:IFQ<1 OR Q>3 THEN780 ELSEPRIN
T@460," "
790 GOTO410
800 IFINKEY$=""THEN800ELSERUN
810 FORX=1TO4:D(X)=0:NEXT:ON RM
GOTO 820,830,840,850,860,870,880
,890,900,910
820 D(2)=1:D(4)=1:D(1)=1:RETURN
830 D(4)=1:D(2)=1:RETURN
840 D(4)=1:D(2)=1:RETURN
850 D(4)=1:D(2)=1:RETURN
860 D(4)=1:D(2)=1:RETURN
870 D(2)=1:D(3)=1:RETURN
880 D(4)=1:D(3)=1:RETURN
890 D(1)=1:D(2)=1:RETURN
900 D(1)=1:D(4)=1:RETURN
910 D(4)=1:D(2)=1:D(3)=1:RETURN
920 ON RM GOTO 930,950,970,990,1
010,1030,1050,1070,1090,1110
930 IFD$="N" THEN RM=10 ELSEIFD$
="E" THENRM=3 ELSEIFD$="W" THENR
M=2 ELSERETURN
940 GOTO1170
950 IFD$="W" THEN RM=8 ELSEIFD$=
"E" THEN RM=1 ELSERETURN
960 GOTO1170
970 IFD$="W" THEN RM=1 ELSEIFD$=
"E" THEN RM=9 ELSERETURN
980 GOTO1170
990 IFD$="W" THEN RM=6 ELSEIFD$=
"E" THEN RM=10ELSERETURN
1000 GOTO1170
1010 IFD$="W" THEN RM=10 ELSEIFD
$="E" THEN RM=7ELSERETURN
1020 GOTO1170
1030 IFD$="E" THEN RM=4 ELSEIFD$
="S" THEN RM=8 ELSERETURN
1040 GOTO1170
1050 IFD$="W" THEN RM=5 ELSEIFD$
="S" THEN RM=9 ELSERETURN
1060 GOTO1170
1070 IFD$="N" THEN RM=6 ELSEIFD$
="E" THEN RM=2 ELSERETURN
1080 GOTO1170
1090 IFD$="N" THEN RM=7 ELSEIFD$
="W" THEN RM=3 ELSERETURN
1100 GOTO1170
1110 IFD$="W" THEN RM=4 ELSEIFD$
="S" THEN RM=1 ELSEIFD$="E" THEN
 RM=5 ELSERETURN
1120 GOTO1170
1130 PRINT@101,"turns left : 0";
:SOUND200,30:GOTO610
1140 CLS:IFWI=1 THENPRINT@43,"YO
U WON!!!":SOUND200,20:GOTO1160
1150 PRINT@43,"YOU LOST.":SOUND1
,20
1160 IFYS=KS THEN SC=SC+40
1170 IFYW=KW THEN SC=SC+30
1180 IFYR=KR THEN SC=SC+50
1190 SC=SC*10
1200 PRINT@106,"SCORE :";SC
1210 PRINT@165,"KILLER : ";SU$(K
S):PRINT@197,"WEAPON : ";WP$(KW)
:PRINT@229,"ROOM    : ";RM$(KR)
1220 PRINT@293,"YOUR SUSPECT":PR
INT@357,"SUSPECT : ";SU$(YS):PRI
NT@389,"WEAPON  : ";WP$(YW):PRIN
T@421,"ROOM     : ";RM$(YR)
1230 IFWI=1 THENSCREEN0,1:FORX=1
TO50000:NEXT
1240 GOTO1240
1250 FORX=227TO252:PRINT@X,CHR$(
128);:NEXT:FORX=291TO316:PRINT@X
,CHR$(128);:NEXT
1260 FORX=1TO6:US$(X)=SU$(X):PW$
(X)=WP$(X):NEXT:FORX=1TO9:MR$(X)
=RM$(X):NEXT
1270 EX$(1)=US$(RND(6)):EX$(2)=P
W$(RND(6)):EX$(3)=MR$(RND(9))
1280 EX$(4)=US$(RND(6)):EX$(5)=P
W$(RND(6)):EX$(6)=MR$(RND(9))
1290 IFEX$(1)=EX$(4) OR EX$(2)=E
X$(5) OR EX$(3)=EX$(6) THEN1280
1300 EX$(3)=EX$(3)+"?":EX$(6)=EX
$(6)+"?"
1310 P$(1)="WAS IT ":P$(2)="WITH
 THE ":P$(3)="IN THE ":P$(4)="OR
 ":P$(5)="WITH THE ":P$(6)="IN T
HE ":P$(7)="IT'S YOUR JOB TO FIN
D OUT":P$(8)="WHO THE MURDERER I
S.":P$(9)="GOOD LUCK!!!"
1320 FORX=1TO9:M=32-LEN(P$(X)+EX
$(X)):M=M/2:PRINT@256+M,P$(X);EX
$(X):FORY=1TO1500:NEXTY:PRINT@25
6," ":NEXTX
1330 GOTO50
1340 A$=INKEY$:IFA$=""THEN1340
1350 RETURN
```

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BASIC09 Interfacing

by Greg Law
Technical Editor

Creating programs in BASIC09 can be a real treat. This is especially true since BASIC09 can make programming a pleasure instead of a burden. You don't even need to exit BASIC09 during your creative efforts. The editor, compiler and debugger are all self-contained. If the program doesn't work the first time, you have the debugger at your disposal, a mere keystroke away. Because the editor automatically checks each line as you type it, many common errors are in listings prevented.

But what if you need a task performed that BASIC09 is not equipped to handle directly? The beauty of BASIC09 is that it *is* equipped to handle most of your needs one way or another. If you can't perform a task directly, you can use the `gfx`, `gfx2` or `syscall` modules to perform the task. If all else fails, you can write your own module using another language such as C or assembly. For our discussion, let's examine the `syscall` module and how it is used.

The first step is to create a structure that is a *mirror image* of the registers used in the 6809 microprocessor. The registers used are the condition codes register (CC), two accumulators (A and B), the direct page register (DP) and three index registers (X, Y and U). The condition codes register and the accumulators are 8-bit registers, while the index registers are 16-bit. The stack pointer (SP) and program counter (PC) registers are not used by the `syscall` module. Therefore, the CC, A, B and DP registers are type `BYTE` and the X, Y and U registers are type `INTEGER`. The next step is to declare the register packet as a variable and declare a variable of type `BYTE` that will be used to hold the system call code. The result is shown in Figure 1.

```
TYPE Registers=CC,A,B,DP:BYTE; X,Y,U:INTEGER
DIM Regs:Registers
DIM CallCode:BYTE
```

Figure 1: 6809 Register Structure

As a simple exercise, let's use the `syscall` module to get our process ID and user ID. Turn to Page 8-22 in the Technical Reference section of the OS-9 Level II manual or to Page 98 of the Technical Information manual included with OS-9 Level I. Here you find the description of the `F$ID` system call. Notice there are no entry conditions, so we do not need to assign any values to the registers. At the top of the page, to the right of `OS9 F$ID`, are three numbers: 10, 3F and 0C. The first two numbers, 10 and 3F, are the machine code values of the `SWI2` assembly language instruction. The third number, 0C, is the system call code for the `F$ID` system call. Therefore, the value of $0C is assigned to `CallCode`.

In the exit conditions it shows the process ID returned in Register A and the user ID returned in Register Y. If there is an error, the carry flag in the condition codes register is set to one and the B Register contains the error code. The format of the condition codes register is shown in Figure 2. To determine whether or not the carry bit is set, test Bit 1 of the condition codes register. This is accomplished by the `IF LAND(Regs.CC,1)=1` test. If the carry bit is set, the statements inside the `IF/ENDIF` conditional are executed. The resulting program is shown in Listing 1.

As another example, let's use the `syscall` module to get the current date and time. The system call code for the `F$Time` system call is $15, and Register X contains the address of a six-byte buffer to hold the date and time. The description of the `F$Time` system call shows that the buffer will contain the year, month, day, hour, minute and second, in that order, as type `BYTE`. As shown in Listing 2, this information is used to create the `TimePacket` structure and declare the variable `Time` using this structure. The statement `Regs.X:=ADDR(Time)` assigns the address of `Time` to Register X. Next the value of $15 is assigned to `CallCode`. Finally the `PRINT` statement prints the date and time.

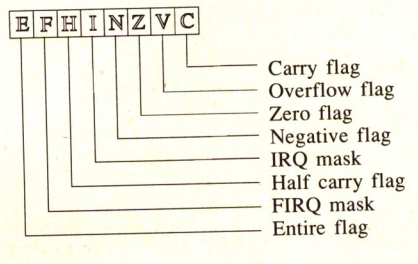

Figure 2: Condition Codes

For a little more sophistication, let's use the `SS.DevNm` Get Status call to get the device name of the screen. Register A contains the path number of the device or file, Register B contains $0E, and Register X contains the address of a 32-byte buffer. The system call code for the `I$GetStt` system call is $8D. Here I use the standard output path, `Regs.A:=1`. You can use the

In addition to being OS-9 Online SIGop, Greg Law enjoys programming on all types of computers and has worked on systems ranging from the CoCo to the Burroughs B6700 super mainframe. He lives in Louisville, Kentucky.

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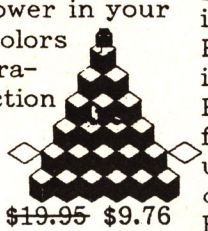
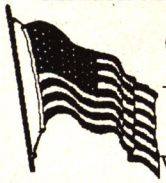


The Freedom Series



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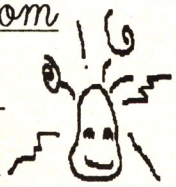
Mental Freedom



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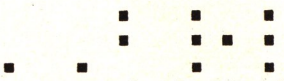
COCO Braille



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WHAT TO WRITE: We are interested in what you want to tell our readers. We accept for consideration anything that is well-written and has a practical application for the Tandy Color Computer. If it interests you, it will probably interest lots of others. However, we vastly prefer articles with accompanying programs that can be entered and run. The more unique the idea, the more the appeal. We have a continuing need for short articles with short listings. These are especially appealing to our many beginners.

FORMAT: Program submissions must be on tape or disk, and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs and debug our typing errors. All programs should be supported by some editorial commentary explaining how the program works. We also prefer that editorial copy be included in ASCII format on the tape or disk, using any of the word processors currently available for the Color Computer. Also, please include a double-spaced printout of your editorial material and program listing. Do not send text in all capital letters; use upper- and lowercase.

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For the benefit of those wanting more detailed information on making submissions, please send a self-addressed, stamped envelope (SASE) to: Submission Guidelines, THE RAINBOW, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. We will send you comprehensive guidelines.

Please do not submit material currently submitted to another publication.

standard input path (0) or the standard output path (2). Alternatively, you can open a file or device and assign the path number returned in the OPEN call to obtain the device name the file is on. Notice that two strings are declared; NameH and Name. The reason is that the device name returned is terminated by setting the most significant bit in the last character. The strhcpy procedure copies this string into a string BASIC09 can deal with properly.

For homework, refer to the mouse routines shown in the "KISSable OS-9" column in the September, 1987 issue of THE RAINBOW. Dale demonstrates some fine examples of setting up and using the Hi-Res mouse in that particular issue. ❑

OS-9

Listing 1: GetID

```
PROCEDURE GetID
0000      TYPE Registers=CC,A,B,DP:BYTE; X,Y,U:INTEGER
0025
0026      DIM Regs:Registers
002F      DIM CallCode:BYTE
0036
0037      CallCode:=$0C
003F      RUN SysCall(CallCode,Regs)
004E
004F      IF LAND(Regs.CC,1)=1 THEN
0061        PRINT "ERROR #"; Regs.B
0073      ELSE
0077        PRINT "Process ID = "; Regs.A
008F        PRINT "   User ID = "; Regs.Y
00A7      ENDIF
00A9      END
```

OS-9

Listing 2: GetTime

```
PROCEDURE GetTime
0000      TYPE Registers=CC,A,B,DP:BYTE; X,Y,U:INTEGER
0025      TYPE TimePacket=Year,Month,Day,Hour,Minute,Second:BYTE
0044
0045      DIM Regs:Registers
004E      DIM Time:TimePacket
0057      DIM CallCode:BYTE
005E
005F      Regs.X:=ADDR(Time)
006D      CallCode:=$15
0075      RUN SysCall(CallCode,Regs)
0084
0085    PRINT Time.Month; "/"; Time.Day; "/"; Time.Year; " "; Time.Hour
            ; ":"; Time.Minute; ":"; Time.Second
00C4      END
```

OS-9

Listing 3: DeviceName

```
PROCEDURE DeviceName
0000      TYPE Registers=CC,A,B,DP:BYTE; X,Y,U:INTEGER
0025
0026      DIM Regs:Registers
002F      DIM CallCode:BYTE
0036      DIM NameH,Name:STRING[32]
0046
```

```
0047        Regs.A:=$01
0053        Regs.B:=$0E
005F        Regs.X:=ADDR(NameH)
006D        CallCode:=$8D
0075        RUN SysCall(CallCode,Regs)
0084        RUN Strhcpy(Name,NameH)
0093        PRINT "/"; Name
009C        END

PROCEDURE strhcpy
0000        PARAM Name,NameH:STRING
000B        DIM Count:INTEGER
0012        DIM i:INTEGER
0019
001A        Name:=""
0021
0022        FOR Count:=1 TO 29
0032          i:=ASC(MID$(NameH,Count,1))
0041
0042          IF i=0 THEN
004E            GOTO 10
0052          ENDIF
0054
0055          IF i>127 THEN
0061            i:=LAND(i,127)
006C            Name:=Name+CHR$(i)
0079            GOTO 10
007D          ELSE
0081            Name:=Name+CHR$(i)
008E          ENDIF
0090        NEXT Count
009B
009C 10     (* Return to the caller *)
00B9        END
```


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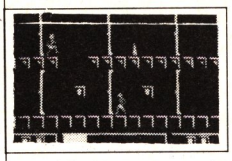

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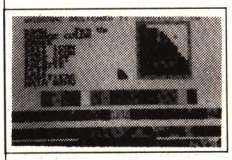

WGD II is a complete graphic oriented war game design system. Create your own graphic icons for units and terrain features. Design your own maps. Assign each unit it's own unique attributes. Then play the games you want to , the ones YOU designed. It's easy. All modules are menu driven, no programing knowledge required. Comes complete with manual, 2 floppy disks and 4 ready to play scenarios. ~~$29~~ ON SALE!!!! JUST $24
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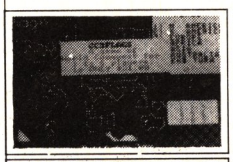

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Reviewed August '89

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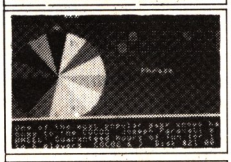

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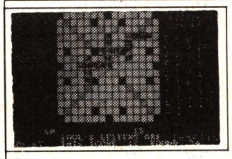
VOCAB



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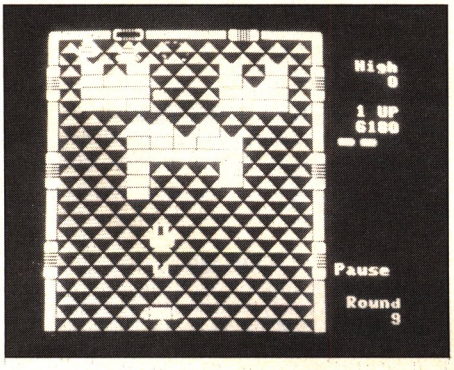
Software — CoCo 1, 2 & 3

Arkanoid — New Variation on an Old Video Classic

Picture a row of bricks crossing a screen slightly more than half-way up. Down the left side you see a high-score indicator, current score, number of lives remaining and a round indicator. At the bottom is a paddle that responds to your control. From out of nowhere a ball suddenly appears, angling steadily down toward the base of the screen. Deftly manipulating the joystick, you send it careening back upward to strike the bricks. As you strike a brick, it disappears and the ball rebounds downward again, gaining speed.

Sound familiar? It should. *Arkanoid*, a new ROM-Pak from Tandy designed for the Color Computer 1, 2 or 3, is by no means a new concept in video games. I was playing games of this genre before there was a Color Computer! It is, however, a new variation on an old classic. And some classics are well worth repeating.



In this latest incarnation, the wall of bricks varies dramatically in shape from one level to the next. In fact the word "wall" doesn't always apply, as the target bricks are distributed on the screen in some intriguing patterns. With some rounds, once you break through the lower layers of bricks, you can almost sit back and watch as the rest are destroyed from above. Other rounds require intense hand/eye coordination and superlative reflexes.

There are variations in the bricks, too. Silver bricks require two or more hits before they disappear, whereas gold ones cannot be destroyed. Random bricks release one of seven types of "reinforcement items" when hit. These reinforcement items are labelled, drift down, and are caught on the paddle for a variety of effects.

The S item slows down the ball. The C item causes the ball to stick to the paddle, then is released again by pressing the firebutton. The E item expands the size of the paddle. Catching the D item splits the ball into three balls, which can inflict greater damage on the remaining bricks (if you can keep them in play). You score an extra paddle (life) by catching the P item, while a B breaks a hole into the next level of play. My favorite is L, which enables you to shoot lasers at the bricks with your paddle by pressing the firebutton.

Arkanoid offers some other interesting new slants. From doors at the top of the playing area, hindering objects (although these objects are more helpful than a hindrance) appear at random intervals. They meander around the top and middle areas of the screen until hit by the ball, at which time they are destroyed, giving you a bunch of points, and the ball is deflected just as if it had been hit by a brick. When you are down to that last brick on any given level, there is nothing more frustrating than getting locked into a pattern that never quite hits the brick. As a hindering object wanders into such a pattern, the ball is knocked into a new course, often taking out the last brick in the process.

Another innovation is an option screen available before starting the game. It enables you to choose the number of players (one or two), which joystick to use and the starting level. There are 22 levels for the Color Computer 1 or 2, and a full 32 for the CoCo 3. When you lose the game, you can immediately continue at the same level, although your score is reset to zero.

Arkanoid is a great deal of fun. The colors are bright, the action fast and challenging, and you don't need to spend hours trying to decipher the manual (which is six pages of short and simple directions) before playing.

I have only two minor gripes with this product — one with the program and one with the packaging. First, I am unable to use my Tandy deluxe joystick. Perhaps I didn't try hard enough since my standard joystick was also plugged in and worked fine. I could not get the paddle to move to the left with the deluxe model, which could be a serious annoyance if that's the only kind of joystick you have!

My other complaint is Tandy apparently feels that the only way to sell a new variation on an existing theme is to give it an outer space scenario. *Arkanoid* is a delightfully simple and engrossing program on its own merit. But the exterior packaging alludes to a mysterious "they" who have "destroyed your planet" and are now "coming after you!" Moreover, a very scant scenario screen (that pops up if you don't start the game right away) provides a weak explanation of some "mother ship" being destroyed, but a "Vaus" manages to escape. The manual refers to your paddle as a Vaus, so presumably you're controlling a space ship.

What a bunch of junk! The only thing even remotely resembling spaceships during play is a laser item that allows you to shoot at the bricks. It's difficult to think of this item in terms of a laser, though, when the shots are accompanied by noise as loud as an explosion.

Arkanoid is a terrific adaptation of a classic game, and it deserves better than to be swaddled in a completely misleading package. Seeing this on the rack in Radio Shack, you don't have any idea what's really inside. But then, I guess that's what reviews are for. . .

(Data East, dist. by Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX; 76102 $34.95: Available in Radio Shack stores nationwide)

— Jim K. Issel

Software — CoCo 3

SuperFile III— A Simply Useful Database

SuperFile III by Gimmesoft is a multipurpose database program that is great for club mailing lists, record collections, inventory, etc. The program runs under Disk Extended Color BASIC on a Color Computer 3 and requires an 80-column display.

SuperFile III is based on a direct access file structure that provides for fast data retrieval. The program supports all the basic functions of a database such as sorting, searching and print formatting, including labels. The program is menu-driven and easy to set up and use. Six pages of documentation adequately explain program

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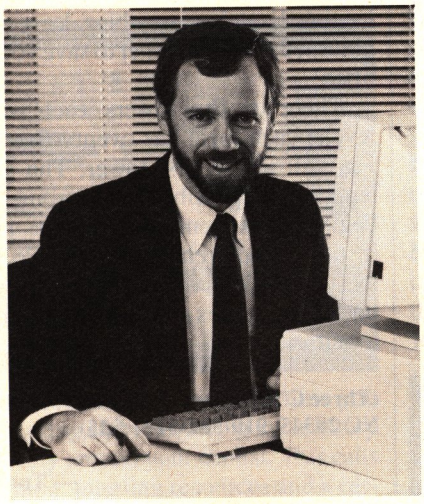

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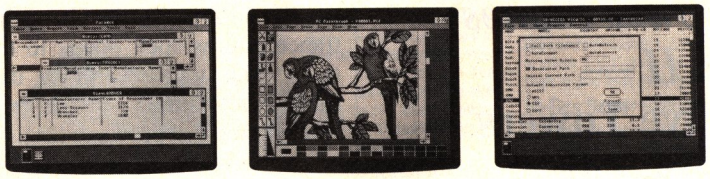

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operation. I ran the program with only minimal reference to the manual.

Although the program is easy to use and adequately provides the capability for managing databases, it cannot go much beyond the complexity of the already described examples. The record structure is limited to six fields with a maximum of 30 characters per field. This field structure is OK for mailing lists but is otherwise limited. As an example, suppose you want to maintain a database for your computer club. Besides the usual fields for name, address, etc., you would want fields for type of computer, date joined, date for dues renewal, type of computer and perhaps an 80-character field for comment. This is not too much to ask for in a database, but it's definitely not possible with *SuperFile III*.

If your database needs are fairly simple and can be confined to a record structure with a maximum of six fields, then by all means consider *SuperFile III*. This program is also available for MS-DOS users.

(Gimmesoft, P.O. Box 421, Perry Hall, MD, 21128; 800-441-GIME; $29.95 plus $3 S/H)

— Donald D. Dollberg

Software CoCo 3

The Power Stones of Ard II — The Five Towers of Trafa-Zar

Ouch! Darn wall, there goes another health point. Where's my torch? I can't see anything in here. Ah, that's better. Now I'm getting somewhere. What was that noise? Who goes there? Oh no, Goblins! Where's my Dagger, Aaaaaaah! (gasp, fade to black)

I haven't gotten far into this dungeons and dragons-type Adventure. I'm playing the role of an apprentice to the wizard Niz. The wizard was planning to transport himself into the five towers of Trafa-Zar using a special powder. There was an accident — a cat knocked the powder over, inadvertently transporting me, not the wizard, into the towers. Luckily Niz had told me what he planned to do. He was going to try and find the Mind Stone.

The Mind Stone is one of the three power stones of Ard. It contains a force of good energy that repels all evil forces. This is in my favor, because the evil wizard, Trafa-Zar, can't get close enough to the stone to use its powers. He has hidden the stone and placed his minion of evil creatures throughout the towers to keep the stone from being recovered by good people.

Before you play, make backups of both sides of the disk. Use your backup disks to play the game. Next, create your character. The character may be male or female, elf or human. Choose the character abilities to best meet your ends. The choices are saved to disk; one character can be saved per disk. If you want to change characters, you can overwrite the previous one or make more backup disks.

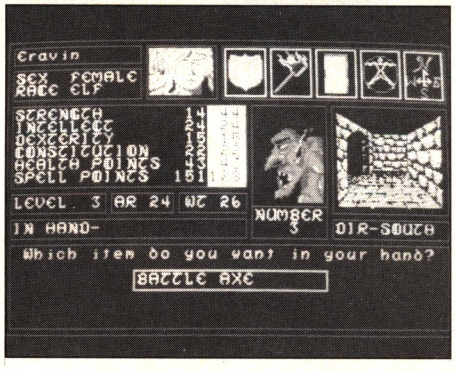
The game screen appears and your Adventure begins. The lively-colored screen is divided into boxes displaying ability scores, a character picture, a spell box, the game level, the item in hand, the text area, your armor rating, the weight of your load, your opponent's picture, the number of opponents, a picture of the room and direction. The information inside these boxes is subject to change, so keep close tabs on it.

You have over 50 spells and action commands to use. Read the manual thoroughly, because you'll probably find a need for every one of them. How prudently you cast spells and slay creatures help determine whether you find the stone.

Casting spells and using action commands drains your character of vital ability points. Each spell cast reduces spell points. Reducing any of the six ability points to zero results in death. Using the wizard trance returns spell points to their maximum. This trance can't be used in the middle of a battle.

I find the fast pace exciting. Once I had to carry a mattress across one level of a tower and drop it in a room with a shimmering blue ceiling. Jumping on the mattress let me go through the ceiling to the next level of the tower. Along the way, I was frantically casting one- and two-key spells as strange creatures appeared around every turn.

In addition to the fast pace, there are several other things that make this game



enjoyable. I found learning all the commands a fun trial-and-error process. For instance, lightning works well against a room full of goblins. Sometimes it helps to turn off the lights before attacking your opponent. Attacking beasts and then running before spell points are exhausted takes a little practice. The beasts give you a good run for your money (or life, rather) if you try to escape! Hand-to-hand combat is time-consuming but not the sole part of the game. The puzzles and riddles are challenging. Examine everything, leave no stone unturned, and remember to save your game often!

There are five towers, each with five levels; each level has twenty-five rooms. I'm still in the first tower. The game is lengthy and possibly too toilsome for the beginning Adventurer. The $25 price is justified. Requirements are a CoCo 3 and at least one disk drive. Options exist for using one or two drives and an RGB or composite monitor.

(Three C's Projects, P.O. Box 1323, Hamlet, NC 28345, 919-582-5121;$25)

— Tony Olive

Software CoCo 3

Overlord — Production of War

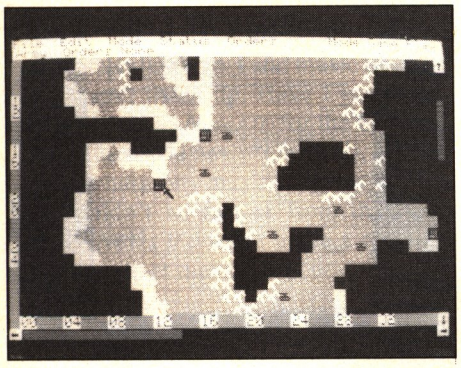
"Hear me mortals! I, Sauron the Magnificent, disciple of Melkor, builder of Barad-Dur, ruler of Mordor and Lord of the Rings, do hereby command you to lay down your arms and surrender to me Frodo the Hobbit." Aside to himself Sauron said, "You can never find a Nazgul when you need one."

Words such as that kept running through my head while playing the Middle Earth map in Oblique Triad's latest CoCo 3 disk game, *Overlord*. It's a fascinating strategy game, perhaps like no other, because you are concerned with production of war material just as much as you are with maneuvering your forces in the field. In addition, you must also become a sea and air power, not just a commander with a massive army. But which has priority? Congratulations, you now have a war game with built-in interservice rivalry.

Oddly enough, even though the game's title is the same as the code word for the June 6, 1944 Normandy invasion, the front cover of the instruction booklet seems to be illustrated with various Warsaw Pact weaponry. That minor technical distraction, however, doesn't detract from the booklet's concise instructions. It guides you

through playing the game and creating your own maps. If you're not in the mood to create your own worlds, the program already includes seven maps.

This is warfare on a grand scale, not a game to be hurried through on a slow Sunday afternoon — unless you have the following week off. It is strategy in the classical sense, because you have to begin



building your forces at the same time you start exploring and conquering the territory immediately around your capital. This calls for planning, juggling resources and a certain amount of low cunning. Depending on the city's industrial capabilities, you can create armies, fighter spy planes, paratroop transports, troop ships, submarines, destroyers, cruisers, battleships and carriers. Some take a lot longer to build than others, and some are needed sooner than others. Deciding what to designate for production after you've captured a city can be a puzzle; only through conquest can you expand your production and your empire. You may have to redesignate a city's armament production during the course of the game. Decisions, decisions.

Fortunately there is a game save option, although it seems to work best if you use a separate disk for the saves. This allows you to avoid sitting up for 172 hours straight as you and your opponent slug it out on the plains or the steppes or in the mountains. Speaking of opponents, the game allows for three players, all of which can be human if you can find two other aspiring warlords. You can turn off one player (electronically of course) and play against the computer. The computer, by the way, does not storm across your expanding borders as if an equivalent of the Fulda Gap existed all over the world.

As I said, the program lets you choose from one of seven maps, or you can create your own by following the easy directions. Since everything is driven from pull-down menus and a joystick or mouse, your typing doesn't have to be of olympic quality. If you are creating your own world, holding the button down on either the joystick or mouse speeds things up. When creating the area near the top of the screen, you might pick up another terrain symbol if you get sloppy.

One neat capability is the Make Shore option, which lets you create curves on your homemade map so your world doesn't look boxy.

When you begin, use the Aran map, which covers a fairly small area. You can get the idea relatively quickly. Also, when you're learning how the system works, or if you want to use a handicap system for newer players, change the production efficiency rating. Of course you can also raise your own production efficiency before beginning to enchance the probability of ultimate victory by implementing surge production techniques and total Quality Management/Statistical Process Control, but remember your mother told you it's not nice to cheat.

The booklet gives you some playing hints, but there is one other thing you should know: Armies may board transports by using the W command; this works if the transport is within one grid square. Otherwise the armies wait until a transport gets within one grid square and then load automatically. Transports, however, can't get through rough water, which is easy to spot (once you know it's there). Unfortunately I'd given the W command before finding that out. This left me with four armies waiting impatiently for the transports that never showed. Throughout the rest of the game, I could hear thousands of tiny electronic voices muttering, "Oh, sure. Here we go again. Hurry up and wait."

As a J.R.R. Tolkien aficionado and honorary member of the Fellowhip of the Ring, my favorite map is Middle Earth. It contains city names such as DolGuldur, Esgaroth, Isengard, Moria and Helms Deep.

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Even though some Tolkien fans might find the use of spy planes and aircraft carriers unusual, you can still imagine the chanting of Orcs, the thrumming of arrows and the clang of swords.

This is an excellent game, an innovative change from the run-of-the-mill moving of land forces until you have superiority. You have to decide on your order of battle and forces composition, then produce it on time while preventing your potential adversaries from conquering you or the lands you want to expand into.

In the meantime, if someone else playing the Middle Earth map locates the Ruling Ring, I'd be glad to trade great quantities of Mithril Mail for it and would even throw in one of the Palantiri to sweeten the deal. I thank you, and my Ringwraiths thank you.

(Oblique Triad, 32 Church St., Georgetown, Ontario, Canada, L7G 2A7 416-877-8149; $29 US, $34 Canadian, plus $2.50 S/H)

— John M. Hebert

Software CoCo 1, 2 & 3

Word Search Puzzle Generator — Computerized Hide-and-Seek

It's hide-and-seek on paper. *Word Search Puzzle Generator* hides words within a matrix of randomly arranged letters, then prints the puzzle on paper. You then find those words and circle them.

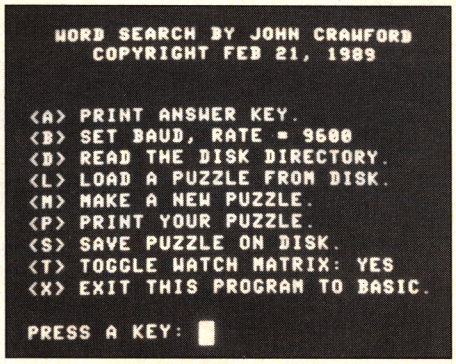
The program prompts you to type each word you want hidden in the puzzle. You may not use duplicate entries, but any combination of letters is accepted as a word. The number of words you can enter depends upon their length; I've entered up to 130 short words. Words that won't fit into the matrix are deleted from your entries.

You have the option to watch the program form the matrix. If you plan on working the puzzle yourself, it would be better to skip this option. After the puzzle is complete, use the Print option to print the puzzle with the hidden words listed in alphabetical order below it.

To save your puzzle to the game disk, you must give it a filename and use the Save option. You can save 35 to 60 game puzzles on the disk, depending on the number of hidden words in each puzzle. This Save feature is listed under a menu that also offers you options to print, load and make puzzles, read the disk directory, print an answer key, set the baud rate for your printer and exit to BASIC.

Besides using *Word Search* for just plain fun, it could be used by teachers in the classroom to familiarize students with vocabulary words or biology terms. For example, if the classroom has access to a CoCo, students could be assigned to design puzzles using only terms within a specific category — as a lesson in classification.

If you can find no practical use for the program, you'll be left to debate whether the mere fun of making and solving hide-and-seek puzzles is worth the $22.95 price. Considering this price, I was surprised to find that no editing feature is in the program; so if you want to add words to or delete words from a puzzle you've already created, you must remake the puzzle.


WORD SEARCH BY JOHN CRAWFORD
COPYRIGHT FEB 21, 1989
<A> PRINT ANSWER KEY.
<B> SET BAUD, RATE = 9600
<D> READ THE DISK DIRECTORY.
<L> LOAD A PUZZLE FROM DISK.
<M> MAKE A NEW PUZZLE.
<P> PRINT YOUR PUZZLE.
<S> SAVE PUZZLE ON DISK.
<T> TOGGLE WATCH MATRIX: YES
<X> EXIT THIS PROGRAM TO BASIC.
PRESS A KEY:

There is no debate, however, concerning how easy the program is to use: a youngster could use it. *Word Search* runs on the CoCos 1, 2 and 3 and requires a printer.

(Second City Software, P.O. Box 72956, Roselle, IL 60172, 312-653-5610; $22.95 plus $2.50 S/H)

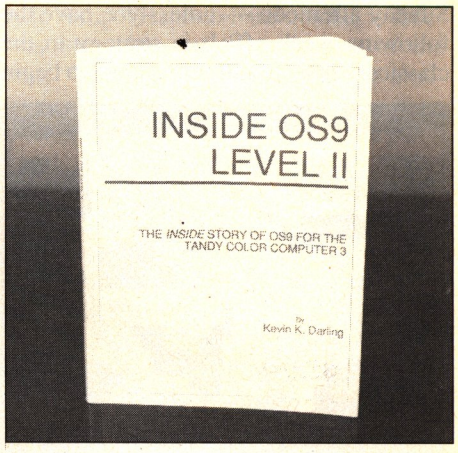
— Kelly Goff

Book OS-9 Level II

Inside OS-9 Level II — A Reference Manual

A nice addition to anyone's bookshelf, *Inside OS-9 Level II* is full of information you'd be hard pressed to find elsewhere. It is approximately 200 8½-by-11-inch pages filled with tables, text and source code. It is not a tutorial on how to use OS-9. Rather, it is a reference manual for those who want to know what goes on in the Kernel during system calls, where tables are located and what they contain, etc.

The book is divided into seven chapters



and starts with an introduction to multitasking principles, memory management and DAT images. Also covered are the steps taken when a process is forked and when a device or file is opened, including the variables used.

Chapter 2 covers the process descriptor, direct page, system memory map and interrupts. It also includes flowcharts of the actions taken during system calls and interrupts. Chapter 3 covers RBF, SCF and Pipe devices as well as the device descriptor and path descriptor formats. Assembly language source for a device descriptor template and flowcharts of the actions taken during I/O system calls are provided.

Chapter 4 gives detailed information about window table formats, fonts and window descriptor formats. Chapter 5 includes patches, corrections to the manuals and a font conversion utility that converts *Graphicom-III* font files to OS-9 font files. Chapter 6 is the goody chapter where you'll find source code for an alarm, utilities to dump blocks of memory, a memory map, a process map, process descriptors and a system memory map. Chapter 7 covers the GIME registers and provides an appendix showing corrections, module header definitions, and video display and error codes.

The utilities alone, I believe, are worth the price of the book. It is the utilities that demonstrate the meanings of the user, process and system memory maps. The book is a treasure chest of information and has found a permanent spot next to my computer.

(Frank Hogg Laboratories, 204 Windemere Road, Syracuse, NY 13205; $29.95 plus $3.50 S/H)

— Greg Law

Notes II — Finish Your Music on a Positive Note

Choir directors, music writers and arrangers, band directors and music teachers everywhere, listen up. Have I got a program for you — *Notes II*, for the CoCo 3.

I can hear you now, "Oh swell, another four-part harmony music program, right?" You couldn't be further from the truth, because *Notes II* doesn't make a sound. It prints the sheet music on your dot-matrix printer.

For those of you who missed the review of the original *Notes* program (RAINBOW, June 1989, by Walter Myers), what we have here is a word processor for musicians. *Notes* and *Notes II* take hand-written manuscripts and print them out in easy-to-read hard copy.

Notes II executes the same way as *Notes*, by typing `RUN"NOTES"`. A title screen appears asking you to select the grand staff or a single stave. After your selection and a short pause to load the rest of the program, *Notes II* asks you to insert your Save disk into Drive 0. The default Save drive can be changed by using the utilities included. Insert your disk and press ENTER to return to the main menu.

The main menu shows what's buried in this program. There are options to change line numbers, look at directories, erase and restore lines in memory, kill lines on disk, load from disk, print, save, change staves, access utilities and, of course, enter the music editor.

Press N to enter the music editor where you must first assign a line number. Select either a single stave or grand staff on which to enter your notes. Clef selection, which includes treble, bass, alto and tenor clefs, is made using two keystrokes. Presto, you have a perfect treble clef; time signatures in four keystrokes, key signatures in three strokes for any key, and one to five sharps or flats drawn automatically right where they should be.

Other music symbols are drawn just as easily: bars, double bars, repeat signs, naturals, accents, crescendos, decrescendos, trills, turns, do-dads, knick-knacks, doohickies and dozens of other musical marks, some of which haven't been seen in a long time. Words can be added to your composition just as easily. This program can write it all.

But what if you make a mistake or don't like what you've written? No problem. Single keystroke erasures, deletions and insertions make error correction a breeze. There is even a small erase for teeny-tiny mistakes.

Utilities include set-ups for most dot-matrix printers at any rate from 300 to 9600 baud. Some experimentation may be necessary due to different control characters, etc., but if you have your trusty printer owner's manual handy, you shouldn't have a problem.

Notes II takes advantage of the CoCo 3's Hi-Res screen. Defaults for both foreground and background are selected from any of the CoCo's 64 colors and easily changed at any time. The notes on the screen appear somewhat tall and thin due to the shape and size of the Hi-Res screen's pixels, but they are very readable. Hard copy is normal size and easy from which to play or sing.

Notes II has several features that are missing from the original *Notes*. First, and most important in my opinion, *Notes II* can handle both single stave and grand staff music. *Notes* can handle only a single stave at a time. Being able to see both the treble and bass clefs is much easier.

Next, *Notes II* saves the stave as a series of keystrokes in a buffer, then writes the buffer to disk. This allows you to save up to 68 staves of music on a single disk. *Notes*, however, stores an entire `PMODE4` screen on disk, limiting storage to just 22 lines.

All of the editing features found in the original program have been retained in *Notes II* except the spooler. The original *Notes* (CoCo 3 version) has one; *Notes II* does not, but my spooler program, loaded in first with 512K, works just fine.

Documentation? How about 31 pages of documentation? Six pages of this are a complete index, another six are a listing of the function keys. Take out the cover page, introduction and table of contents and you have a concise sixteen pages of instruction that tells you all you need to know.

I did find one musical occurance that *Notes II* could not handle. Occasionally, especially in piano music, two notes on the same stem are only a single step apart. Because of this, one note on the stem must turn in the other direction. I could not find a way to get the program to draw these notes. A quick call to Robert Pori, programmer and violinist, assured me that not only has this been fixed, but other improvements are being made as well.

Notes II requires a CoCo 3 with 128K and a single disk drive. I recommend an RGB monitor for better resolution and a second drive for music storage.

This is not a program for everyone. It does not play music, write music or teach music. But if you like to write, arrange or rearrange music, if you teach or direct a choir or a band, you have a use for *Notes II*.

At $45 the price may seem a bit high, but it is worth every cent. Well-written, easy-to-use programs that are functional, fun and reasonably-priced don't come along often. For the music lover, *Notes II* is all three.

(Robert Pori, 137 Wingfoot Ct., Aptos, CA 95003, 408-688-0115; $45)

— Randy Cassel

*** EXTENDED * ADOS-3**

*** Built-in RAMdisk * Point-and-pick file select menu ***

Not a new version of ADOS-3, but a new product that shares space with ADOS-3 in a 16K EPROM. Arrow-key selection of files to execute, LOAD, COPY, KILL or SCAN. The BACKUP command is doubled in speed for full disks, proportionately faster for partly full disks. (BACKUPs to or from the RAMdisk typically take 5 to 20 sec.) • BACKUP-with-format • Wild-card COPY and KILL, with optional prompting for individual files • Date (or date/time with hardware clock) displayed for files in the directory, printed on LLISTings • DATE$ function • Key repeat • Block move/copy of BASIC program lines • Text screen printer dump • Auto-reboot of a BASIC program or the DOS command • Parallel printing • Read/write/format 35/40 tracks on 80-track drives • Supports 3 double-sided drives plus 2 RAMdrives • Allows different numbers of tracks on different drives • Shares the original's excellent compatibility with commercial software. For 128K CoCo 3 with ADOS-3 (RAMdisk use requires 512K). Includes information on having an EPROM burned (cost is $15) after configuring Extended ADOS-3. Disk, **$39.95.** Extended ADOS-3 plus ADOS-3, **$64.95.** Driver for Disto real-time clock, **$5.** Adapter for controllers lacking 28-pin socket, **$10.** SmartWatch real-time clock (Tandy 25-1033 equiv.), **$35** (Drivers for Ext. ADOS-3 and OS-9 included; usable in 28-pin socketed controllers or in Rompack, **$10).**

"...will blow your socks off...impossible to give Extended ADOS-3 anything other than a rave review." — Rainbow, October 1989.

"Flawless, compatible operation with just about everything under the sun...by far the most USEFUL product ever devised for the Color Computer." — CoCo Clipboard, Sept/Oct 1989.

ADOS-3 (reviewed July 1987)
Customize default startup message, colors, screen width, baud rate, step rates, processor speed, number of tracks (35, 40, or 80). Disk I/O and printing are reliable at double CPU speed. Extra commands such as FAST, SLOW, AUTO, RUNM, SCAN, CAT, PRT ON/OFF. Keystroke macros, arrow-key scroll through BASIC programs, edit/repeat of last command, auto-edit of error line, ML monitor, lots more. Usable as a disk utility or in EPROM. 128K Coco 3. EPROM-burning (cost is $15-20) information provided. Disk, **$34.95.** **ADOS** for CoCo 1 and 2 Disk, **$27.95.**

FOR OS-9: SmartWatch real-time clock with driver, **$30.00;** in Rompack, **$40.00.**

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Master Catalog, a utility that organizes up to 3,000 disk filenames. It supports single- and double-sided drives, alphabetizes, sorts, searches & finds, and prints a columnar hard copy of your directory listings. The program works on any Color Computer with at least 32K bytes of RAM and requires a disk drive and RS-DOS versions 1.0 or 1.1. *Second City Software, P.O. Box 72956, Roselle, IL 60172, 312-653-5610; $19.95.*

Master Catalog III, a utility that organizes up to 3,000 disk filenames on the CoCo 3 only. It supports single- and double-sided drives and alphabetizes, sorts, searches & finds and prints columnar hard copies of your directory listings. It takes advantage of double speed for sorting the filenames and uses the 80-column screen. An RGB monitor is recommended. *Second City Software, P.O. Box 72956, Roselle, IL 60172, 312-653-5610; $19.95.*

Notes II, an update of *Notes*, a music word processor for the CoCo 3. The program lets you create, edit and print professional-looking, single-stave sheet music. Some new features include the use of CoCo 3's Hi-Res screen, the ability to draw single and grand stave music lines, onscreen help and the ability to draw horizontal and vertical lines. Requires a disk drive, 128K and a dot-matrix printer. *Robert Pori, 137 Wingfoot Ct., Aptos, CA 95003, 408-688-0115; $45.*

Screenview 1.0, a set of machine language subroutines that enhance graphics material on the CoCos 1, 2 and 3. The routines are accessed through BASIC and let you slide the contents of Screen 2 into Screen 1 from any direction. There are 29 routines in all that help you to improve the presentation of your graphics onscreen. *Software Crafters, 13 Topez Terrace, Diamond Vale, Diego Martin, Trinidad, WI, 809-637-5412; $8.95.*

1990 CoCo Tax Estimator helps you predict your tax liability. It follows the arrangement of the Internal Revenue Service's 1990 Form 1040 ES. For the 512K CoCo 3 using OS-9 Level II and an 80-column monitor. The program is *Multi-Vue* compatible. *Puritas Springs Software, The Ameritrust Bldg., 17140 Lorain Ave., Cleveland, OH 44111, 216-251-8085; free offer.*

Keyboard Template, a posterboard accessory that fits around the CoCo keyboard. It has most of the commands and functions to operate and program any Color Computer model, including those for graphics. *P&M Products, 1003 Shalimar Drive, High Point, NC 27260, 919-279-3091; $6.95 plus $2 S/H.*

Mailman, a database management program designed to provide maximum management of information intended for postal mailing applications. Runs on any CoCo with ECB, 32K of memory, a disk drive and any printer operational with your CoCo. *Johnson Software, P.O. Box 92, Dayton, OH 45449, 513-866-2601; $39.95 plus $2.50 S/H.*

Mailist Pro To Mailman Data, converts *Mailist Pro* address data files to data files acceptable by *Mailman*. A working knowledge of *Mailman* is necessary to run the program. Runs on the CoCos 1, 2 and 3 with ECB and a minimum of 32K memory. Requires a single- or dual-disk drive and works with any printer used with the CoCo. *Johnson Software, P.O. Box 92, Dayton, OH 45449, 513-866-2601; $9.95 plus $2.50 S/H.*

Check-09MV, a checkbook register-keeping program written in BASIC09 for the CoCo 3 running *Multi-Vue*. Supports all types of banking transactions centered around your checkbook. Prints a hard copy similar to a monthly bank statement. Requires OS-9 Level II and *Multi-Vue*. *Second City Software, P.O. Box 72956, Roselle, IL 60172, 312-653-5610; $25.95.*

Revelation, a software package for the CoCo 3 that lets you use 225 lines of vertical resolution in all Hi-Res graphics modes and 28 lines of text, including an optional status display line. It supports 62 macro keys, high-speed disk access, lowercase command entry, and control and international characters enterable from the keyboard. *Robert E. Offermann, II, 2447 Oak Park Way, Orlando, FL 32822, 407-282-6272; $25.*

Tuty, a fruity game for the CoCo 2 or 3, in which the object is to gain points by saving apples, pineapples, cherries, watermelons, grapes and strawberries. Fruits roll on the screen like a slot machine; you save or discard them and either roll again or keep the points you get on the first roll. For one to four players. Joystick and RGB monitor optional. Available on Disk only. *CB Games, P.O. Box 2496, Kalispell, MT 59901, 406-257-3832; $24.95.*

Baby BASIC, a tutorial on how to access the extra memory in your computer to store and execute BASIC programs. Also included is how to chain program sections from disk without erasing variables. For any CoCo with 64K or more, and a disk drive. *Danosoft, P.O. Box 124, Station A, Mississauga, ONT, L5A 2Z7, Canada, 416-897-0121; $8.95 U.S., $10.50 Cdn. plus $2.50 S/H.*

Gnome Quest, *In Search of the Spirit Sword*, an arcade action quest game in which you are a gnome seeking out Jerane, a would-be wizard who has stolen the Spirit Sword. The journey takes you through a cavern and over an ice mountain, requiring you to jump from platform to platform using the joystick. Requires a CoCo 3, one disk drive and a monitor — RGB or composite recommended. *SPORTSware, 1251 South Reynolds Road, Suite 414, Toledo, OH 43615, 419-389-1515; $21.*

Gnome Quest II, *Firespire*, an arcade-action quest game in which you play the role of a gnome who must recover the Firespire, hidden near five monuments. The area surrounding the monuments is infested with deadly creatures you must avoid or destroy while reaching for the Firespire. Requires a CoCo 3, joystick, disk drive and a TV or monitor. RGB or composite monitor recommended. *SPORTSware, 1251 South Reynolds Road, Suite 414, Toledo, OH 43615, 419-389-1515; $21.*

Wholenum, drills users on addition, subtraction, multiplication and division of whole numbers. The program gives positive feedback using sound and comments onscreen as well as a reward game for achieving a specified number of correct answers. Allows for several players to practice. Runs on a CoCo 1, 2 and 3 and does not require ECB. *CoCoSoft Educational Software, P.O. Box 665, House, NM 88121, 505-279-6455; $8 ppd.*

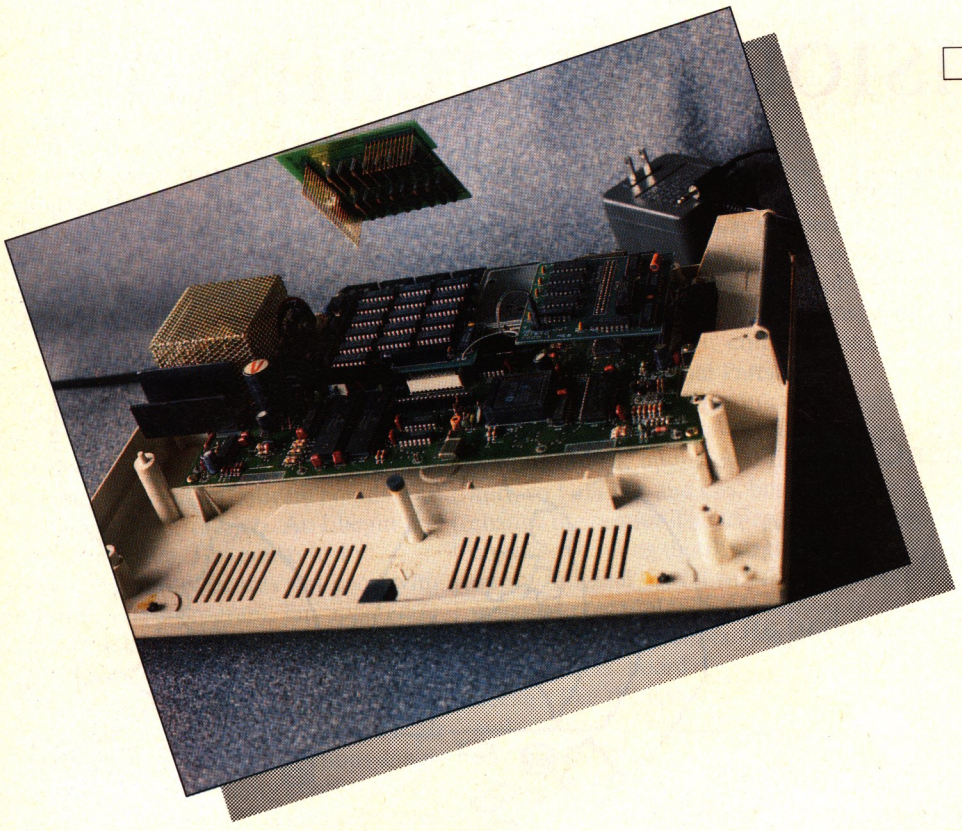
Classic Solitaire, 3-in-1 solitaire pack that contains Klondike, Pyramid and Canfield solitaire played according to Hoyle's book of card games. Full color 320-by-192 graphics. For the CoCo 3 with one disk drive. RGB and composite/TV displays recommended. *Eversoft Games Ltd, P.O. Box 3354, Arlington, WA 98223-3354, 206-653-5263; $14.95 plus $2 S/H.*

Games Pack I (CoCo 3 Version or CoCo 2 Version available), three popular family games on one disk! *Pardon Me, Roy* is a full-color graphics version of hangman. Enter your word lists, up to 100 words per list, or make them up as you go, playing against yourself or other players. *Brainbuster* is our version of concentration, in which you choose your gameboard size and the difficulty of play. *Mastermind* also included. Requires a disk drive. *Eversoft Games Ltd, P.O. Box 3354, Arlington, WA 98223-3354, 206-653-5263; $10 plus $2 S/H.*

First product received from this company

The *Seal of Certification* is open to all manufacturers of products for the Tandy Color Computer, regardless of whether they advertise in THE RAINBOW.

By awarding a *Seal*, the magazine certifies the program does *exist* — that we have examined it and have a sample copy — but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW reviewers for evaluation.



Hardware

CoCo 3

1-Meg Upgrade — Light at the End of the Tunnel

I am sitting in a dimly-lit room, pecking on the computer and listening to some light jazz in the background. At long last I finish writing all of the source code and it is time to take a break and compile it. It takes a few light-years to compile and, of course, it is giving me a few dozen errors. Fortunately I have decided to print the error listing on the printer so I don't have to remember all of them. Back to the grind of editing and compiling!

I think this will probably work a lot faster on a RAM disk so I spend another 30 minutes making a new boot disk. It works the first time and boots without any problems. I initialize the RAM disk and copy all of my source code, libraries and # `include` files. Now it is time to compile again. Oops, now I don't have enough memory for the compiler. Bummer. Time to reboot without the RAM disk and wait for the light-year compiler again. There must a better way.

Just when you think the world is coming to an end things really start getting better. This day is particularly brilliant — a warm spring day and the birds are chirping outside. But that has to wait; the 1-Meg Upgrade kit from CRC/Disto has arrived and it promises to solve the world's problems — well, at least the memory problems I'm facing.

Quite a hefty little package, the Upgrade kit comes with two small PC boards, an external power supply, installation instructions, and a disk that contains software to test the RAM and patches for OS-9. The 512K RAM board plugs into the 512K upgrade sockets, and your existing 512K board installs onto this board piggy-back style. Another board installs on top of the 68B09E CPU chip via a 40-pin header connector.

Installation is definitely not for the novice and requires some delicate soldering. If you are not proficient at soldering and can do without the computer for a few days, CRC will install and test the 1-Meg upgrade for you. The documentation guides you through the installation procedure every step of the way, stopping after every step with checkpoints to make sure everything is progressing smoothly.

Looking over the kit, I see that each pin on the 40-pin header connector must be soldered to each pin on the 68B09E CPU chip. This actually appears to be a male wire-wrap style header connector with pins bent at angles to fit snugly onto the CPU. You can put the header connector on the CPU and it pretty much holds itself in place, so you don't need four hands to solder with. Once the header connector is soldered, you solder a 1-inch wire across R22. That's it for the soldering.

The thoroughness of the documentation baffles me at times. It instructs you to use an ohmmeter to check the continuity of each pin, not once but three times. You must check it twice to make sure none of the pins are shorted, and then again to make sure each is making good connection. You are also instructed to power up the CoCo to make sure it still works, then install the PC board onto the header connector and power up the CoCo once more.

"Poker Showdown, a video game of high tension and realism"

—*The Wall Street Journal*, March 15, 1990, page 1

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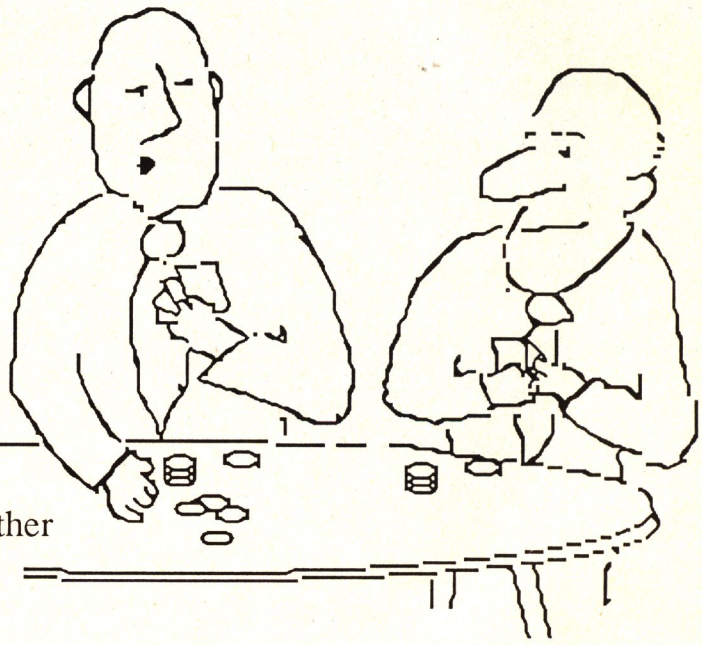

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The documentation instructs you to remove your existing 512K board and install the 512K board included with the 1-Meg Upgrade kit, connect the external power supply to the connector on the 512K board, and run the memory test. Finally, you are to install your original 512K board, power up the CoCo, and run the memory test three times. Did he say three times? Yep.

There is a small wire on the 512K board that comes with the 1-Meg Upgrade kit. This wire installs into one of three pins on the satellite board. Two of these pins select the upper or lower 512K board, and the one in the middle enables the board selection signal to select between the two 512K boards. The first two tests make sure the two RAM boards are working properly; the final test makes sure the satellite board and all 1-meg of RAM is working.

Installation is straightforward, so I don't think I'll have a problem with it since I worked seven years as a computer technician, and soldering on delicate boards was a standard part of the job. As I begin the project, I discover I'm not so lucky.

Both of my 512K boards test good with the memory test program, but apparently the board select signal isn't working. The memory test program only tests 512K no matter which pin I connect the jumper to.

I quickly pull everything apart and go through the installation instructions again, starting with the continuity checks. Everything checks out OK, but it's got me puzzled because CRC thoroughly checks the kit before shipping it to make sure it works flawlessly. I must be goofing somewhere; I call them and they tell me to recheck the solder connections again. Once again my ohmmeter shows no shorts and zero ohms on all connections, and a visual check shows everything should be great. Could my trusty meter be giving me false readings? Well my Beckman digital meter is no slouch and hasn't failed me yet.

With determination I reach into my tool kit and grab my spring-hook — a long, slender metal rod with a hook on the end — and use it to pull on each of the pins to make sure they are soldered snugly to the CPU. A half-dozen pins later I distinctly feel one pin moving. Oops, chalk one up to a poor solder joint. Grabbing my trusty soldering iron, I resolder that pin and check all the others just to be safe. Putting the CoCo back together, I run the memory test and this time it passes. Feeling better now that it is working, I curse myself for not doing a better soldering job on that pin.

I boot OS-9 Level II and apply the patches to `grfdrv` and reboot the system, running the `mega` command included with the upgrade to enable the extra 512K. Everything looks good so far. I initialize the RAM disk and start compiling. Talk about a major difference! Not only does the compiler run fast, but with a 192K RAM disk and the entire C compiler and *DynaStar* loaded into memory, I have more free memory than I had originally with nothing loaded.

Feeling like I'm on cloud nine, I create a graphics window and run a program that generates and solves random mazes. The program runs fine for about ten minutes and then locks up with a colorful display. Instantly I start suspecting problems with the GIME chip. After all, I have an original GIME chip dated 1986. I discuss the problem with Kevin Darling and he also suspects problems with the GIME chip, so I order a new one from National Parts.

I make a quick call to CRC; they suggest I cut both C65 and C66 — standard practice with most 512K upgrades. I figure it can't hurt, so I cut C65 and C66, but that doesn't change the results. The maze program still crashes. Thinking this through, I recall that on my original 512K I installed a 41-ohm resistor in parallel with R22 instead of cutting the two capacitors. Maybe the D.P. Johnson 512K board doesn't like the RAS and CAS timing with any other value of R22, so I remove the jumper from R22 and try it again. This time the maze doesn't run two minutes before it crashes. Aha! R22 at zero ohms works for ten minutes and R22 at 120 ohms works for two minutes. Thinking I am on to something, I install the 41-ohm resistor in parallel with R22 and try it again. Ten minutes later the CoCo is still running the maze program so I leave it running all night. The next morning it is still running like a charm and even runs throughout the weekend.

A few days later I called CRC and a representative informed me that the graphics problem had been discovered and fixed. According to this spokesperson, most, if not all, CoCos with this problem are fixed by installing a new GIME chip (dated 1987) or adjusting the value of R22. My system has been rock solid since I adjusted the value of R22. I installed a new GIME chip just to be on the safe side.

I've been using the 1-Meg Upgrade for quite some time now and have completely fallen in love with it. Aside from the initial problems, it has been a very reliable product. It makes life so much easier. With the extra 512K I have enough memory to load practically everything I normally use and still have enough memory left to get the work done. The staff at CRC are very friendly and are willing to help in any way they can. If you don't feel comfortable installing the 1-Meg Upgrade kit, a representative from CRC will gladly install the kit for you and make sure it works reliably before returning the CoCo to you.

(CRC, Inc., 11 Boul. des Laurentides, Laval, Quebec, H7G 253, Canada, 514-967-0195; $199 plus $8 S/H)

— Greg Law

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Intercom

An important link in the CoCo community is its ability to communicate with fellow users. If questions arise, a fresh source of information can be invaluable. We here at THE RAINBOW have decided to create "Intercom," an information exchange point for Pen Pals, CoCo Clubs and BBSs.

If you would like a Pen Pal or are running a CoCo Club or BBS, send us a letter including the information listed here to: The Rainbow Intercom, P.O. Box 385, Prospect, KY 40059.

PEN PALS

✍ I'm 14 and have a CoCo 3. I'm looking for male or female writers. I don't know a lot about computers, so please keep your letters simple. I'll try my best to answer all letters.

Rachel Langkamp
9228 79th St.
Edmonton, T6C 2R5
Canada

✍ I'm inquiring if anybody has a BBS in Vancouver, British Columbia, Canada. I have a CoCo 3, a CoCo 2, a Multi-Pak, an RGB monitor, a composite monitor, a disk drive and a dot matrix printer.

Alexander Stevenson
1855 West 11th Ave.
Vancouver, B.C. V6J 2C4
Canada

✍ I'm 11 and looking for a pen pal around my age. I have a CoCo 3 and a CCR-81 cassette deck. I would like a pen pal from anywhere around the world.

Robin Rottler
1641 2nd St. North
WI Rapids, WI 54494

✍ I'm interested in finding pen pals mostly from Australia. I have a CoCo 3, monitor, a Star NX-1000 printer, disk drives and a 1200-baud modem. I'm a real CoConut. I'm interested in new age music, hiking, bicycling, electronics and all aspects of computers, especially telecommunications.

Michael Holtry
272 Hill St.
Idaho Falls, ID 83402

✍ I'm 23 years old. I have a CoCo3, one FD-502 disk drive and a Star NX-1000 Rainbow printer. I would like American pen pals my age or older. I'm interested in learning assembly language and electronic hardware projects. I'm pretty good with BASIC. I also have CoCo MAX III and love making pictures and scrapbooks.

Tika Carr
Box 264
2117 Buffalo Road
Rochester, NY 14624

✍ I am a mom, grand- and great grandmother with many interests including the CoCo 3 with 512K of memory. I prefer a pen pal age 40 and up, but I'll answer to anyone who has similar interests (e.g., daycare and preschool teachers). Please, no chain or religious mail.

Phyllis J. Tichi
10325 Lunar Drive
Flagstaff, AR 86004

✍ I'm 18 years old and I'm looking for pen pals. I have a CoCo 3, disk drive and DMP-110 printer. I enjoy arcade games, Adventures and using the CoCo as a MIDI sequencer using *Lyra* and a Yamaha YS-200 synthesizer. Anyone interested can write in English or Spanish. I will answer all letters.

Jorge De Albertis B.
Av. Benavides 1530-301 Miraflores
Lima-18 Peru, South America

✍ I'm 46 years old and have taught myself as much as I can about the CoCo. There's still a lot I need help with. I'm vocally handicapped, so it's not easy for me to ask someone about the CoCo. I'm on a party line, so I can't use a modem. I would appreciate someone helping me by one-on-one correspondence. I will supply a SASE for each reply in the correspondence. I have a CoCo 3, Extended BASIC, a single disk drive and a DMP-130 printer. I would like some infomation and recommendations about expanding my hardware and software in order to do more with the CoCo. I particularly need help getting into RS-DOS and OS-9.

Terry L. Rains
Rt. 1, Box 159-B
Jacksonville, AR 72076

✍ I am a 19-year-old Air Force linguist (translator). I'm looking for pen pals (any age between 15 and 23), male or female. I have a CoCo 3, modem, CCR-81 recorder, and various game cartridges. I like telecommunicating, and I can be reached by means of the Hayes BBS (1-404-HI-MODEM). Access to this network is free, as is membership. Leave a message for ROBERT LYON anytime. My interests include science-fiction, blues, soul, new age music and computer and arcade games. (nearly anything computer-related) I'll answer all letters or messages.

Robert E. Lyon
Route 1, Box 237-B
Lumberton, MS 39455

CoCo CLUBS

CALIFORNIA
☎ Marysville\Yuba City Area CoCo Club, Jim Vestal, P.O. Box 5126, Marysville, 95901, (916) 742-5499

CONNECTICUT
☎ Southeastern Connecticut Color Computer Users Group, Larry Donovan, 25 Stony Brook Road, Stonington, 06378, (203) 535-4211

FLORIDA
☎ Cross-Country Color Computer Club, Tom Tittle, 860 Gardenia Drive, Royal Palm Beach, 33411, (407) 798-3726

GEORGIA
☎ Atlanta Computer Society, Inc., Alan R. Dages, 4290 Bells Ferry Road Suite, 10639, Kennesaw, 30144, (404) 469-5111 (voice), (404) 636-2991 (modem)

IDAHO
☎ Snake River Color Computer Club, Emil Franklin, 1750 Carmel Drive, Idaho Falls, 83403, (208) 522-0220

ILLINIOS
☎ Quincy Color Computer Club, Steve Wellman, 1600 Highland Lane, Quincy, 62301, (217) 224-8307

IOWA
☎ Mid Iowa CoCo, Terry Simons, 1328 48th, Des Moines, 50311, (515) 279-2576

KENTUCKY
☎ Hardin County Color Computer Club, Paul Urbahns, 2887 Republic Ave., Radcliff, 40160, (502) 351-4757

LOUISIANA
☎ The CoCo Sig, Christopher Mayeux, 20 Gibbs Drive, Chalmette, 70043, (504) 277-6880(voice) or (504) 277-5135(modem)

MARYLAND
☎ Arkade, John M. Beck, 3513 Terrace Drive #D, Suitland, 20746, (301) 423-8418

MICHIGAN
☎ Color Computer Owners Group, Bernard A. Patton, 388 Emmons Blvd., Wyandotte, 48192, (313) 283-2474
☎ Greater Lansing Color Computer Users Group, E. Dale Knepper, P.O. Box 14114, Lansing, 48901, (517) 626-6917

NEW YORK
☎ The Island CoCo Club, Dennis Zobel, P.O. Box 426, Massapequa, 11762
☎ Kings Byte CoCo Club, Morty Libowitz, 1063 E. 84th St., Brooklyn, 11236, (718) 763-4233

NORTH CAROLINA
☎ Norca Users Group, Matthew Royal, Route 21 Box 906, Fayetteville, 28304, (919) 484-1230

OHIO
☎ Dayton Area Color Computer Users Group, John Teague, 308 Orangewood Drive, Kettering, 45429, (513) 434-9168
☎ Dayton Color Computer Users Group, Steven E. Lewis, 4230 Cordell Drive, Dayton, 45439, (513) 299-3060
☎ The Greater Toledo Color Computer Club, Bill Espen, 1319 North St., Bowling Green, 43402, (419) 471-9444
☎ Tri-County Computer User Group, Ron Potter, 10914 Oliver Road, Cleveland, 44111, (216) 476-2687

PENNSYLVANIA
☎ Cumberland Valley Users Group, Thomas Martin, 9085 Newburg Road, Newburg, 17240, (717) 423-5525
☎ Pittsburgh Color Group, Ralph Marting, 309 Frazier Drive, Pittsburgh, 15235, (412) 823-7607

RHODE ISLAND
☎ New England "CoCoNuts" Color Computer Club, Arthur J. Mendonca, P.O. Box 28106 North Station, Providence, 02908, (401) 272-5096(Sig3)

SOUTH DAKOTA
☎ Empire Area Color Computer Users Group of South Dakota, Carl Holt, P.O. Box 395, Brandon, 57005, (605) 582-3862

TEXAS
☎ Mid Cities TRS-80 Users Group, Rob Yoder, P.O. Box 171566, Arlington, 76003, (817) 535-7931

VIRGINIA
☎ Richmond Area Color Computer Organization, William T. Mays Jr., 6003 Westbourne Drive, Richmond, 23230, (804) 282-7778
☎ Southwestern Virginia Color Computing Club, Ricky Sutphin, Route 1 Box 20, Henry, 24102, (703) 365-2018

WASHINGTON
☎ Spokane Color Computer Club, Richard Baysinger, W. 2217 Sanson, Spokane, 99205, (509) 326-2793 or BBS(509) 325-6787

WEST VIRGINIA
☎ Huntington Area Color Computer Symposium, Jim Bush, P.O. Box 391, Lesage, 25537-0391, (304) 736-5314

AUSTRALIA
☎ Australian National OS-9 Users Group, Gordon Bentzen, C/- 8 Odin Street, Sunnybank, Queensland, 4109, (07) 345-5141
☎ Brisbane Southwest Colour Computer Users Group, Bob Devries, 21 Virgo St., Inala, Queensland, 4077, (61)-7-3727816

CANADA
☎ Halifax Dartmouth Color Computer Users Group, David H. Haley, Comp. #7 Greenforest Subdivision, RR#1 Lower Sackville, Nova Scotia, B4C 2S6, (902) 864-0454
☎ Les CoCophiles Du Sud-Ouest, Jean Labrose, 20 Ste-Julie #A, Vaudreuil, Quebec, J7V 1B5, (514) 455-0486

PUERTO RICO
☎ Puerto Rico Color Computer Club, Luis R. Martinez, P.O. Box 2072, Guaynabo, 00657-7004, (809) 799-8217 or (809) 728-2314

State/City	BBS Name	Access Number (Baud rate-Parity-Word Bits-Stop Bits)	Parameters	SysOp
California				
Marysville	09-Online BBS	(916)742-6809	300/1200-N-8-1	Jim Vestal
Colorado				
Colorado Springs	The Time Safari	(719)635-7228	300/1200-N-8-1	David Vallier
Florida				
Cocoa Beach	KB Enterprises' CEBBS[1]	(407)799-3282	300/1200-N-8-1	Kevin Berner
Illinois				
La Grange Park	S & V BBS	(708)352-0948	300/1200/2400-N-8-1	Paul Jerkatis
Kansas				
Beloit	Kansas Konnektion BBS[2]	(913)738-5613	300/1200-N-8-1	Gary N. McCarty
Louisiana				
Harvey	The Node 3	(504)347-4320	300/2400-N-8-1	Gene Clifton
Michigan				
Taylor	J & L's CoCo Corner	(313)292-4713	300/1200/2400-N-8-1	Jim Snider
Minnesota				
Brainerd	Brainerd 4-Way[3]	(218)828-1144	300/1200/2400-N-8-1	Mike Lowe
North Carolina				
Concord	The Stargate BBS	(704)788-7867	300/1200/2400-N-8-1	Jim Brock
Oklahoma				
Tecumseh	Pat BBS[4]	(405)598-5082	300-N-8-1	Pat Aldridge
Pennsylvania				
Conshohocken	Chalie's Help Line	(215)825-3226	300/1200-N-8-1 or N-7-1	Charles DiMartino
Johnstown	CoCo Electronic BBS[5]	(814)535-1497	300/1200/-N-8-1	Albert Baldish
Virginia				
Henry	Public Access[6]	(703)365-2018	300/1200-E-7-1 or N-8-1	Ricky Sutphin
Canada				
Lunenburg, N.S.	Color Nova BBS	(902)634-3095	300/1200/2400-N-8-1	John D. Cleveland

Notes:
[1]KB Enterprises' CEBBS is up 5 p.m. to 9 a.m. seven days a week (EST).
[2]Kansas Konnektion BBS is up from 10 p.m. to 7 a.m.
[3]Brainerd 4-Way is up from 8 p.m. Saturday to 5 p.m. Friday.
[4]Pat BBS is up 5 p.m. to 9 p.m. weekdays and 10 a.m. to 10 p.m. weekends. This new BBS is counting on you for uploads.
[5]CoCo Electronic BBS is up 8 p.m. to 6 a.m. seven days a week. Press return a few times to get connected.
[6]Public Access is up from 12:30 a.m. to 9 a.m. Monday through Sunday.

Continued from Page 6

Logitec Paintshow Plus, etc. Of course to get this up and running I also needed expansion slots in the 1000 HX and additional memory.

I found that I needed at least a 20-Meg hard drive to handle the bargain items, in addition to everything I had already purchased. When I totaled everything, I was in the neighborhood of $1200 and would still have to spend about another $650 for the hard drive. At this point I sat down, reviewed my needs and realized that the CoCo 2 and 3, when combined with my old reliable RAINBOW, programs from RAINBOW ON TAPE and DISK, and Telewriter-64, gave me everything I needed from my computer. I returned the 1000 HX and most of the other items and happily paid the restocking charge where necessary.

I know THE RAINBOW is a little leaner than it was a few years back, but as long as you keep your good writers and advertisers, I'll keep subscribing.

Philip Beltz
Harlington, Texas

Fuzzy Monitor Blues

Editor:

I have been enjoying THE RAINBOW for over two years now, and in that time I have not missed an issue. In the March 1990 issue you ran a program, *Scope*, which I read with great interest. Using my CoCo 3 as a storage scope would be extremely helpful in my job. Using it as a triggered storage scope would be even better. I really like its high-speed capability as I need to look at signals on the order of .75 milliseconds.

I was thrilled when I tried running Mr. Barden's *Scope* program. It was a real heartbreak when, after my computer perfectly drew the graticules, the writing it put on the screen was nothing but gibberish. I'm using a color TV for a monitor.

Is there is some way the program can be modified so I can use my TV? I took the program over to a friend's house, and his composite monitor didn't do any better than my TV. We did not type in the program; we had it on RAINBOW ON DISK.

Please send me the program correction as soon as possible, so I can at least use the storage scope. Please give the triggered storage scope idea some thought.

Gary Brown
Phoenix

The fuzzy screen writing is not a result of some problem in the Scope *program. Rather, it is a result of the poor text resolution of most TVs and color composite monitors. When viewed on a monochrome or RGB monitor, the text appears crisp.*

Looking for Bumper Sticker

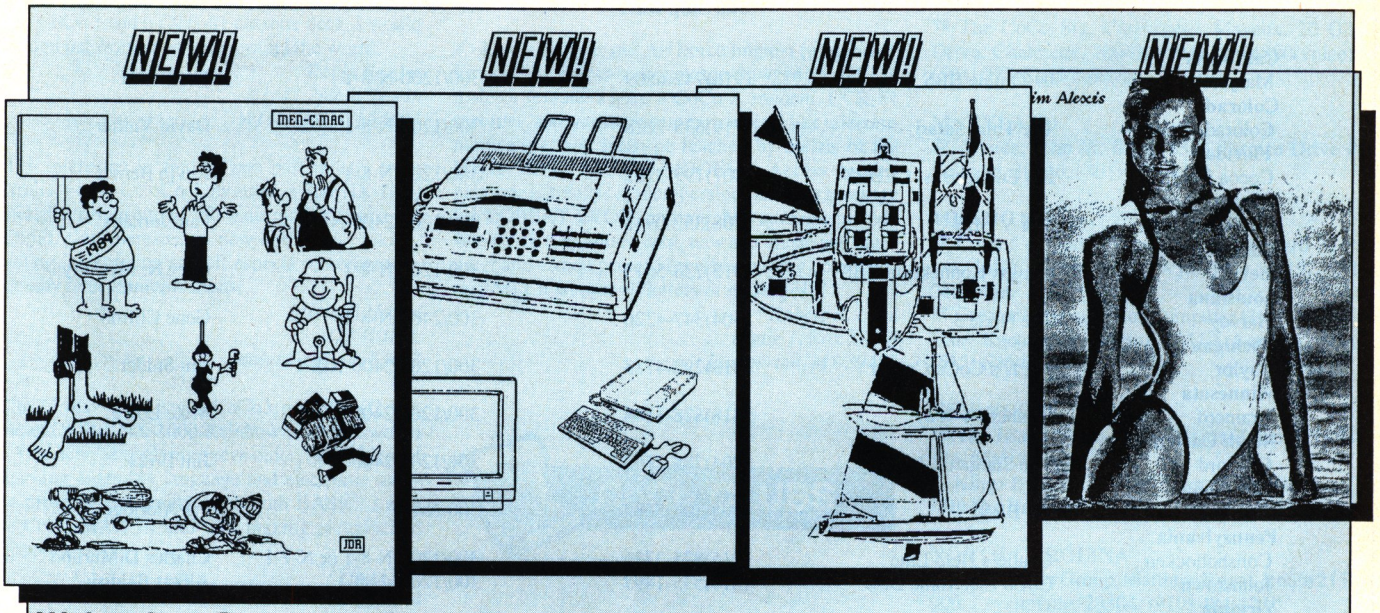
Editor:

Does anyone know of a program that prints out text and graphics in the proper size for a bumper sticker? Where can I find bumper sticker blanks?

James Ruth
128 Seymour Ave.
Newark, NJ 07108

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or to conserve space.

Letters to the editor may also be sent to us through our Delphi CoCo SIG. From the CoCo SIG> prompt, type RAI to take you into the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, type LET to reach the LETTERS> prompt and then select Letters for Publication. Be sure to include your complete name and address.



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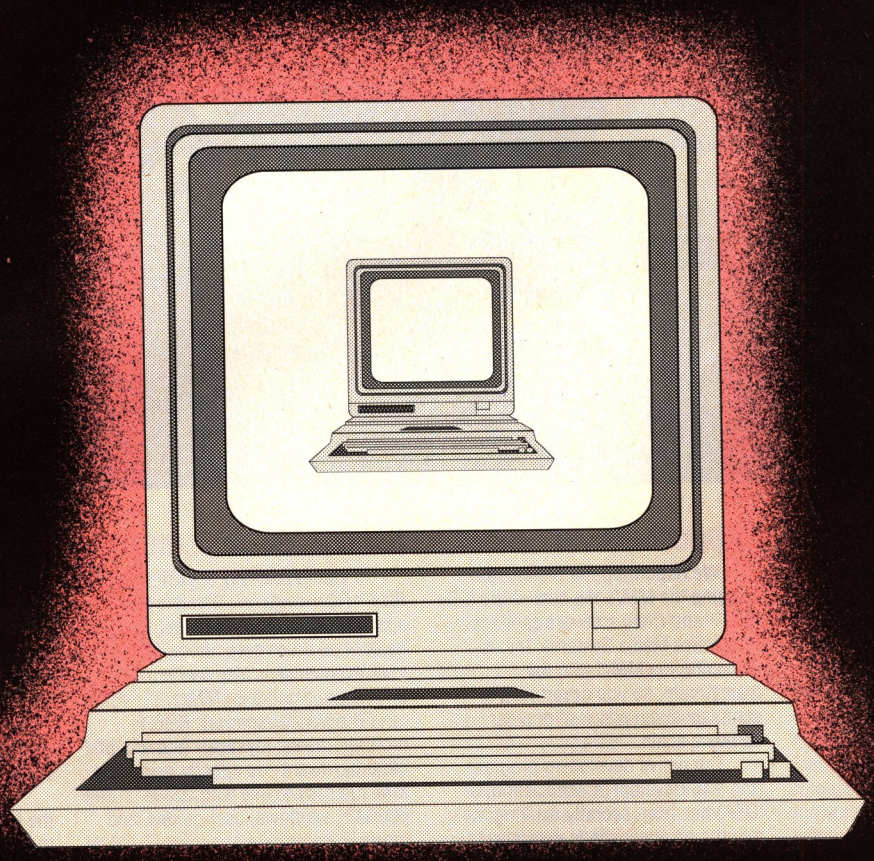
In the Beginning . . .

Your CoCo is the longest-lived, most innovative and, surely, best-loved Computer ever to hit the market. In constant use by millions of us for a decade now, its story is both an interesting and fascinating one. And now you can relive it all — all the fun, the people, the frustrations — in *CoCo: An Affectionate History of the Tandy Color Computer*.

This anecdotal history of the CoCo, by well-known authors Dale and Esther Puckett, tells the stories of those people at Tandy who brought us the Color Computer; the programmers who've put the 6809 through its paces; the hardware gurus with their electronic marvels; and the many vendors who have made these innovations available to us. You'll also read about people like you who have supported the Color Computer with countless hours at the keyboard and by attending CoCo functions. You never know — you might even read about yourself. And this says nothing of the many pictures you'll see.

CoCo: An Affectionate History is scheduled for release early in the fall of 1990. Prior to publication it will be available in an attractive limited-edition hardcover version for only $45. A softcover version will also be available for $15.95. But if you order now, you can reserve copies of the softcover version for a pre-publication price of just $13.50 apiece. Reserve a copy of *CoCo: An Affectionate History* for yourself. Or order several for those you care about — and take a walk down Memory Lane together.



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Our active developers program (the IMS Developers Association, or IDEA) has been secretly working for months on applications exclusive to the MM/1. These graphics editors, sound sampling programs, and animation utilities bring you unprecedented software power.

Give us a call to get a listing of all the vendors and developers supporting the MM/1. Ask us, too, about the colleges and universities around the United States already using the MM/1 in computer science and multimedia labs, pushing back computing frontiers with the same computer that is now available to you.

Smart.

If you're thinking of buying an IBM™ PC, Amiga, or Atari ST, think again. Much of your CoCo hardware is useless on these computers. All of your experience is also useless — unless you acquire an MM/1.

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Personal Computing recently reported that about one of every four MS-DOS users will abandon it in the next two years in favor of UNIX-style computing. Why? Because they want multitasking windows. The MM/1 has multitasking windows and goes beyond most UNIX computers with its graphics, sound, and ease of use.

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But you can do it all on the MM/1.

Free.

For no extra charge, the MM/1 includes software worth over one thousand dollars. OS-9/68000, C compiler, Basic, IBM PC File Manager, tape backup support, a graphics editor, and more. Right out of the box. And enjoy a built-in software library that will give you plenty of power for years to come.

Customer satisfaction is built into the MM/1, too. Call for details on how to get your money back if not satisfied. And service? If ever you run into a problem, get in touch with us by phone, on information services, and on our exclusive customer BBS.

A quality staff backs up the MM/1. The IMS team includes top people from international computer firms as well as folks rooted in the CoCo world, and each person is committed to you.

Compare.

The MM/1 costs far less than comparably equipped PC compatibles, Amigas, and Atari STs. When you shop for a new computer, use this checklist for comparison.

For $779,

you get an MM/1 with...

- slimline case with 200 Watt power supply
- a full one Megabyte of memory!
- a high-density floppy drive (1.4 Megabyte capacity)
- graphics resolution up to 720 x 540
- up to 256 colors from a palette of 16 million colors
- a true multitasking operating system — OS-9/68000
- windows, applications, utilities — $300 value!
- 2 serial ports, for printers, mice, terminals ...
- MIDI-capable for the music hobbyist or professional
- PC keyboard port for XT style detachable keyboard
- Uses CM-8™ or similar monitor
- 15 MHz CPU — runs circles around the Amiga!
- built-in graphics coprocessor
- expandable with optional 32-bit high-speed bus

In other words, if you buy any other computer, you will probably get shortchanged.

Systems.

MM/1 Kit (1 Meg single board PCB, with software) 2 serial ports, PC keyboard port, RGB-A port, operating system, applications, instructions **$659.**

MM/1 Personal (above with case, floppy drive, ready to go) **$779.**

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Other hot items from IMS are also available. Just call our toll free number to order what you like.

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NC residents add appropriate sales tax. Some items require a small postage charge. Call for details.

Giveaway.

Thousands of people are already lining up to buy the MM/1. But if you'd like an MM/1 of your own, free, read this.

If you come to the Atlanta COCOFEST at the Atlanta Lakewood Holiday Inn, Oct. 6-7, Kenneth-Leigh Enterprises and Interactive Media Systems, Inc. will be there in full force, showing off the MM/1, its networking and graphics, its advanced windowing, and digital sound.

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Computer Widow's Tale:
STUFF

I watched as my husband brought home some STUFF,
I asked him exactly what the STUFF was;
He just mumbled things I didn't understand,
and that is when my story began.

I went down to his office to give him what for,
tripping over the STUFF that was piled on the floor:
behind boxes and paper and styrofoam pieces
was my husband cornered with our cat named Peaches.

There were computers, printers, joysticks, Numberjacks—
monitors, modems, three or four Multi-Paks,
hardware, software, all kinds of computerware —
STUFF that looked like it came from a nightmare.

I pictured the STUFF climbing up to my kitchen,
a massive stampede with an appetite itchen,
devouring everything like a big hungry hog —
including me, my birds, and my dog.

So I ran upstairs and started to pout;
I cried my heart out on our comfy ol' couch,
when all of a sudden I heard the steps creak:
IT WAS THE STUFF COMING TO GET ME!

I grabbed some newspaper and hid behind
a big rocking chair that used to recline.
I made me a gun and looked real tough
and waited 'til I saw the first sign of the STUFF.

Around the corner came fire-eating dragons,
drunken old knights started throwing their flagons.
Hundreds of spaceships hovered over my head
as all the commanders shouted "CODE RED"!

Creatures belonging at an alien zoo,
ten-legged, no-legged; there were some with two.
They were long and slimey, creepy and hairy;
there was even a nerd, in a suit, named Larry.

Zap, zap, zap went my newspaper gun.
I didn't stop zapping 'til I knew I had won.
As the smoke cleared away, I about threw up,
when I saw the mess from all the dead STUFF.

I crawled from my hiding place torn and tattered,
but the STUFF was gone, so that didn't matter.
I got out my broom and some Lysol spray,
swept up the remains and threw them away.

Then I began to wonder where my husband could be.
Wasn't he worried what had happened to me?
Maybe the STUFF had attacked him too
and turned him into a pile of goo.

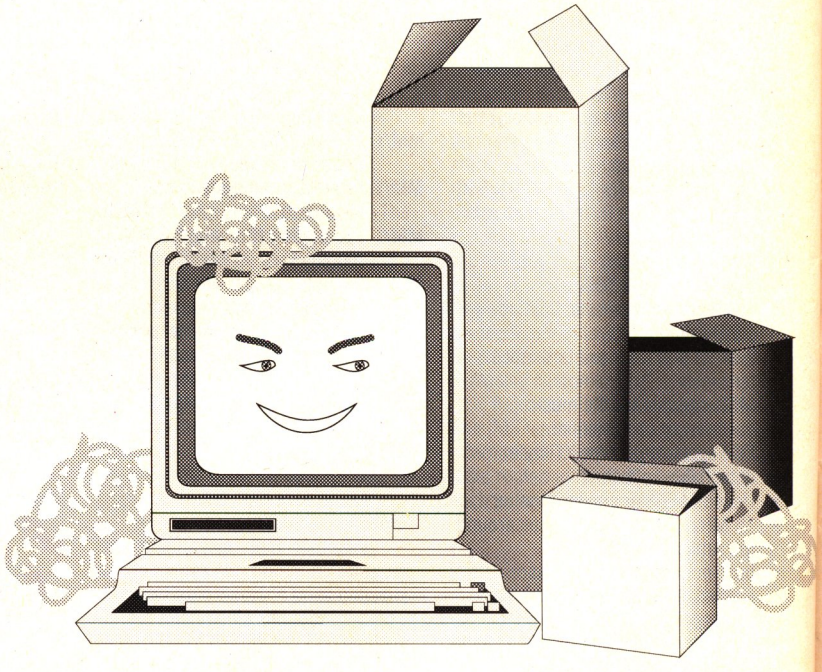
I rushed downstairs calling his name,
stopped dead in my tracks for his room wasn't the same.
No boxes or paper, no styrofoam pieces
were covering him up, or our cat named Peaches.

"Look what I did," he said with a smile.
"What do you think of my neat little pile?
I hope I didn't wake you making all that noise,
but it was a good time to pick up my toys."

"There is one thing," he continued to tell me,
"something that has made me very, very angry.
I set my favorite games over by the stairs,
but when I went to put them away—they weren't there."

Well, a year has gone by, and I never said
that I zapped his STUFF and it was dead.
Just think of what that boy would say,
if he knew what went out on garbage day.

— Nancy Myers



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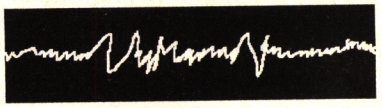

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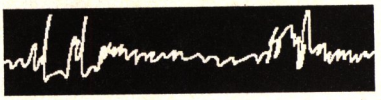

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The Tenth Round

Over the years, I have been a bystander to many arguments between Disk BASIC and OS-9 users. OS-9 proponents speak of the many virtues of multitasking and multiple windows. Opponents point out that OS-9 isn't necessary and is "difficult to learn." Both factions of Color Computer users have valid points. But one question that goes through my mind is, "Where has this bickering lead us?"

For one thing, it has lead to stagnation. With people so busy being stubborn, we're all missing a number of opportunities for growth. Of course there are those who have picked a path and intend to follow it. We hope to publish information about their new machines in the near future. The point is, the CoCo Community seems to have come to the belief that complaining about what we haven't got is more important than forging ahead into new territory. I am reminded of the old Tareyton cigarette advertisement; but personally, I'd rather switch than fight.

Another result is the very uncomfortable chasm over which THE RAINBOW sits. Recent mail shows a great deal of positive feedback for our efforts to increase coverage of OS-9. But we still get letters asking why we bother to put that "junk (OS-9)" in the magazine? Let's face it, OS-9 *is* a part of the CoCo Community. As such, THE RAINBOW will continue to support it as much as it can. With the reduced number of pages (a direct result of a drop in advertising, which is a direct result of the stagnation we see) this task becomes increasingly difficult.

Try as they might, opponents cannot stop OS-9 without hurting the community as a whole. Not supporting OS-9 (through submissions to THE RAINBOW and buying OS-9 and products designed for it) is like being a boastful fighter and wanting to tie one arm behind your back to prove yourself. No matter what, you're still missing an important part and taking a big chance of losing the bout because of it.

Another interesting aspect of all this is an obvious but gradual change in the computer market as a whole. A clear example is the tendency of users to drop the CoCo entirely from their computing habits and move to using MS-DOS exclusively. Of course this tendency blows to pieces the argument that OS-9 is difficult to learn. MS-DOS is no easier to learn, and OS-9 is more powerful. What, then, are these people really looking for? Ready-to-run software! Products that take little effort to use and do just about everything but butter their toast for them. Users are moving away from hands-on learning about their systems to buying canned software.

Mind you, I have nothing against these products. I am, however, pointing out that the availability of powerful canned software on the CoCo and other systems has contributed to a general complacency in the CoCo Community. I used to complain to OS-9 programmers about the lack of useful applications available to attract more Disk BASIC users to the system. I no longer believe the solution lies there. I think it lies with all of us.

The CoCo has always been a machine for learners. In the beginning, a lack of third-party support dictated that users had to create their own software to get what they wanted from the machine. People were intrigued by computers and wanted to learn all they could. This curiosity resulted in a great deal of knowledge being passed from hand to hand. It appears those days are over. But need they be? I don't think so.

"OS-9 is too difficult to learn. I won't gain anything from it." Pshaw! Let's be honest now. Because I almost fell into this trap myself, I have come to understand that such statements often come from those who have lost touch with the desire and willingness to learn new things — something the CoCo Community has relied on from the beginning.

We're not planning on making THE RAINBOW an OS-9 magazine. But we will continue to support this part of the CoCo Community. In keeping with my premise that OS-9 provides a means of putting an end to our complacency and offers us a chance to get back on track, we are now opening "Novices Niche" to BASIC09 submissions. We challenge you, especially those who are just making a decision to experience BASIC09's power, to share your ideas in the form of programs. BASIC09 submissions to "Novices Niche" must be 75 printed lines or shorter in length. We welcome programs that fall into any category, but we are especially looking for those that present a commonly needed application and illustrate innovative uses of the CoCo to get a job done. We hope you'll take the initiative to discover just what you can do.

— Cray Augsburg

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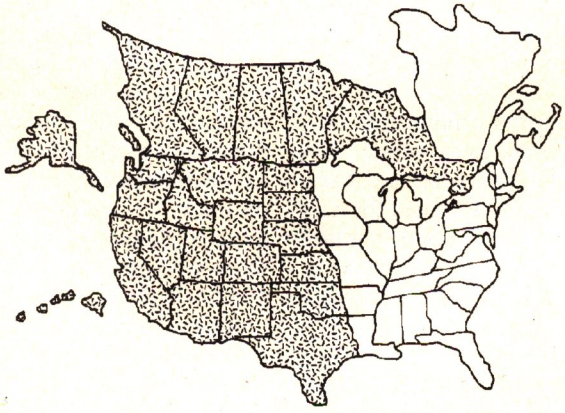

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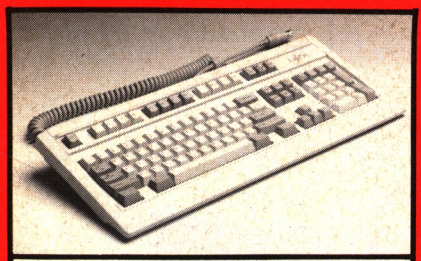
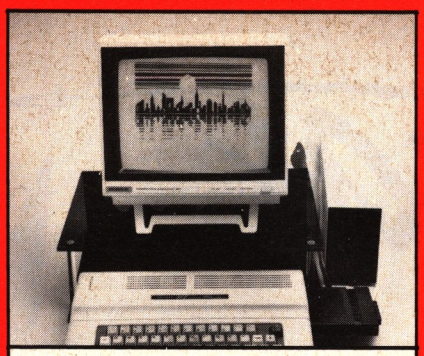


KEYBOARD

- 101 Keys with tactile touch
- Coiled cable with RF filter
- can be used with CoCo, Tandy or IBM and auto senses XT or AT

KB-1	Keyboard	$98.00
KB-A	CoCo Adaptor	$89.50
KB-1A	Keyboard & Adapt.	$149.00



MAGNAVOX 7622 AMBER OR 7652 GREEN

- 80 Column
- Built in Speaker

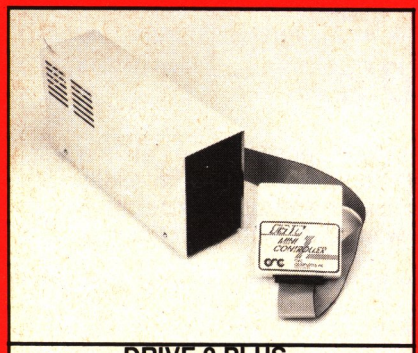
$98 (7 ship)

DISTO BOX

DC-7	Mini Controller	$ 75.00
DC-3	Super Controller	$ 98.00
DC-6	No Halt Controller	$129.00
MBA-1	3 in 1 Board	$ 69.45
MEB	Mini Expansion Bus	$ 30.00
RS232	RS-232 Port	$ 49.95
DC-3C	Clock and Parallel Port	$ 40.00

PRINTERS

STARNX-1000R	COLOR	$249.00
STARNX-1000II		$189.00
VA-1	Video Converter for CoCo 1&2	$29.45
HR-2	Dual Hi-res adapter	$39.45



DRIVE 0 PLUS

- Double sided 360K MPI 52
- Disto DC-7 controller and cable **$158.45**
- **Double Drive 0+ $268.45**
  Drive 0 + Drive 1 (TEAC)

MEMORY

• 512K Bare Board	**$40**
• Populated 512K & Software	**$89**
• 1 MEG Bare Board	**$160***
• Populated 1 MEG	**$200***

*requires 512K upgrade

FLOPPY DRIVES

52	MPI 5¼ Full Height 40 track Double Sided 360K	$39.45
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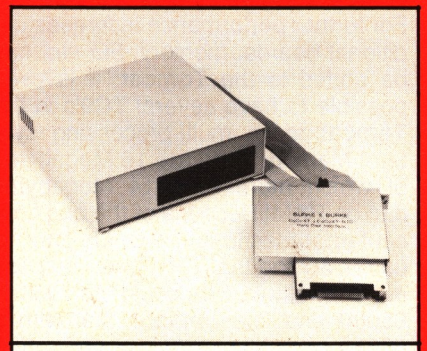
SLOT-PACK II by Chris Hawks

- replacement for multipack
- 3 slots, 2 switchable
- X slot for RS-232 for modem (specify)
- middle slot can take disk controller or ROM cartridge
- 12 Volt adaptor required so power is not drawn from CoCo

MP-II	slot pack II	$89.45
AC-12	12 volt adaptor	$14.95



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See Rainbow Reviews 8/89

HD-1	**10 Meg****	**$349**
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HD-4	**40 Meg**	**$598**
HD-8	**80 Meg**	**$1,090**

*Burke & Burke **reconditioned

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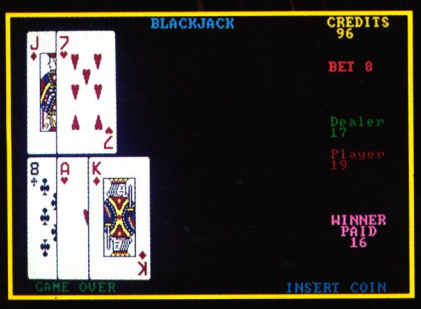
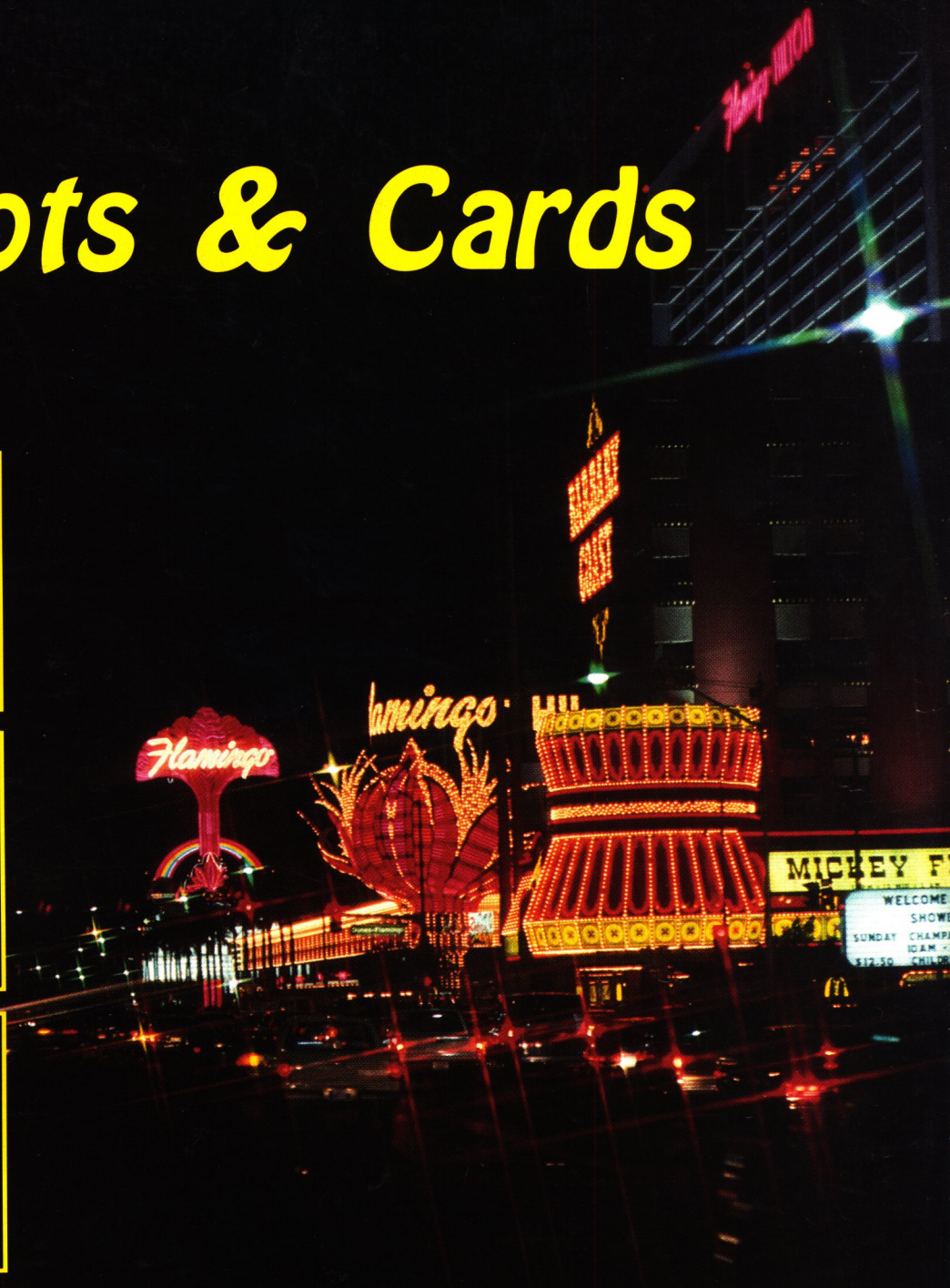
Slots & Cards

VGA Graphics Depicted





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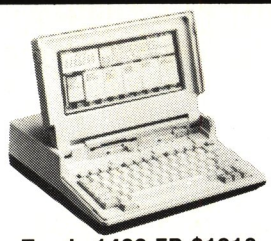
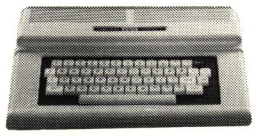


Tandy 1400 FD $1219
Tandy 102 32K $439*
Tandy WP-2 $249*



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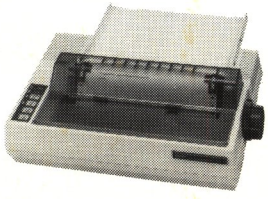
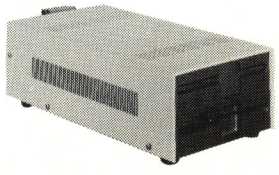


DMP-133 $289



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Drive 0 $239 Drive 1 $149

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